THE Journal

OF THE AMERICAN DENTAL ASSOCIATION

APRIL

1957

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VOLUME 54

NUMBER 4

New Denture Development Opposes Porcelain Uppers to Plastic Lowers

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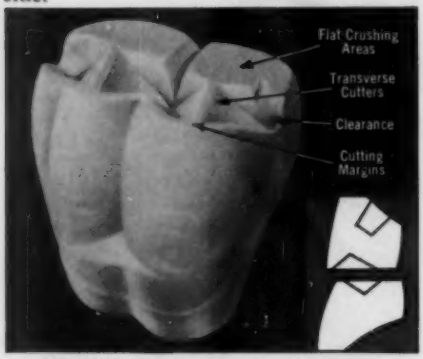

Shows details of occlusal construction of new Myerson and Sears posteriors. Insert drawing shows how upper and lower meet in one plane.

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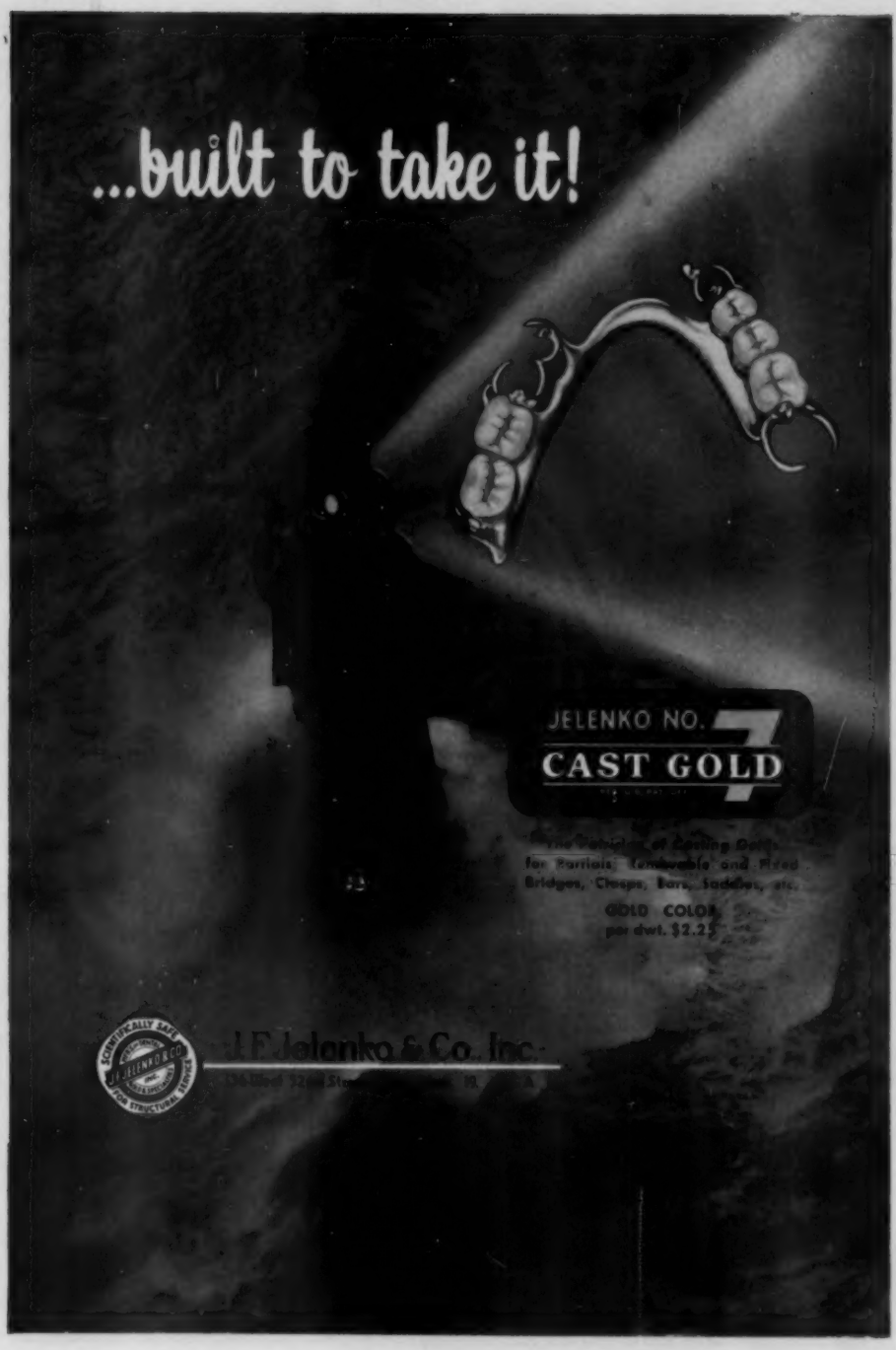
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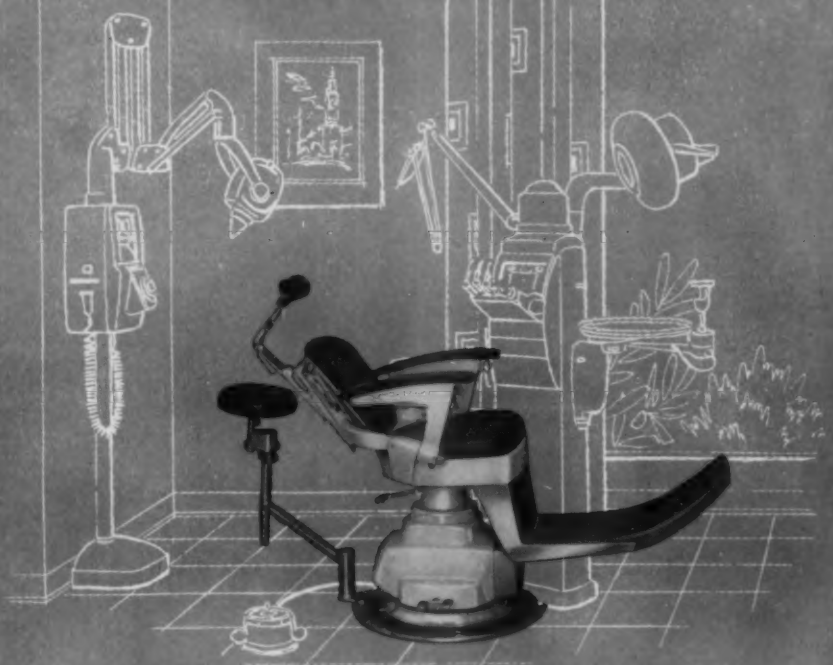

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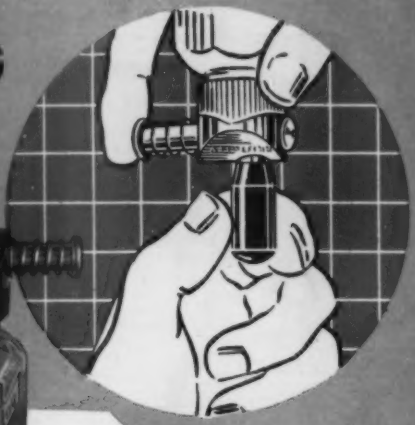

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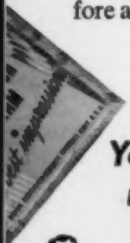

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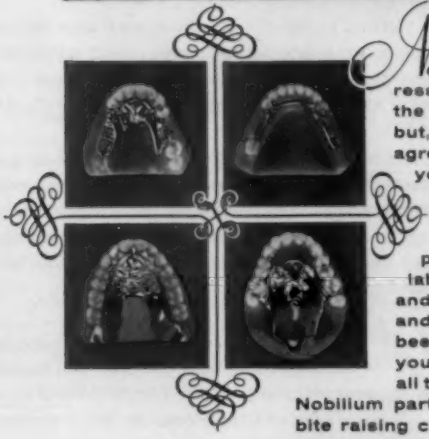

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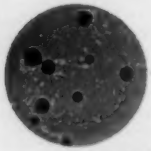

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APRIL 1957 VOLUME 54 • NUMBER 4

THE Journal OF THE AMERICAN DENTAL ASSOCIATION

Review of 1956 dental research

The Council on Dental Research herewith presents a review of dental research reports published in 1956. This is the second annual report of this kind. The first, covering research reports of 1955, was published in the April 1956 issue of THE JOURNAL. The Council hopefully anticipates that the current review will warrant the same favorable comments accorded the initial review of a year ago. Grateful acknowledgment for assistance is hereby given the consultants who have reviewed the material and prepared the various reports: Iden N. Hill, Ralph Ireland, Floyd D. Ostrander, George C. Paffenbarger, Ward Pigman, Ph.D., and James H. Shaw, Ph.D.

Today, dental research is so broad and divergent that it no longer falls within the purview of one individual. In some areas within the scope of dental science, active research is lagging far behind that of other fields. The specialty groups should recognize the importance of both fundamental and applied research in each of their disciplines and encourage at least a limited experience in research principles and methods for board qualification.

This review edited and collated by J. Roy Blayney, vice-chairman, Council on Dental Research.

DO YOU KNOW

What is ahead in dentistry?

Do you know:

1. The relation of nutrition to the shape and size of molars?
2. The importance of adequate protection of your patient and staff from overexposure to roentgen ray radiation?
3. That water fluoridation has reduced caries in the six year old Evanston, Ill., children by approximately 80 per cent?
4. That 69 per cent of the resting saliva is derived from the submaxillary glands, 26 per cent from the parotid glands and 5 per cent from the sublingual glands?
5. The most approved technic for pulpotomies?
6. The current status of tranquilizing drugs in the modern practice of dentistry?
7. The responsibility of clinicians for the interpretation of research to their patients?

FLUORIDATION RESEARCH AND RELATED DEVELOPMENTS

Iden N. Hill, D.D.S., Chicago

Caries prevention is now considered a broader concept than the repair, extraction, and replacement of teeth. The frequent and proper use of the toothbrush, the regulation of the intake of fermentable carbohydrates, and the use of fluorides are suggested procedures to retard dental decay. Research studies pertaining to the prevention and control of dental caries should motivate the dental profession to practice, the school officials to sponsor, and the public to accept those methods of prevention and control which have been proved to be of value.

CHEMICAL ACTION OF FLUORIDES

Research reports published during the past year which gave additional knowledge of the mechanism of the chemical action of fluorides on enamel and dentin include the following: the distribution of fluorides in enamel of permanent and deciduous teeth,[1,2] the effects of fluorides on the permeability of human dental enamel to inorganic ions,[3] the prophylactic effect of a solution of sodium fluoride applied topically to teeth *in vitro*,[4] the uptake of tin and fluorides by intact

Assistant professor, Zoller Memorial Dental Clinic, University of Chicago.

1. Brudevold, F.; Gardner, D. E., and Smith, F. A. Distribution of fluoride in human enamel. J. D. Res. 35:420 June 1956.

2. Brudevold, F. Some considerations of fluoride in relation to dental caries. J. New Jersey D. Soc. 27:15 Jan. 1956.

3. Brewer, H. E.; Muhler, J. C., and Fischer, R. B. Effects of fluorides on the permeability of human dental enamel to inorganic ions. J. D. Res. 35:59 Feb. 1956.

enamel,[5] an analysis of the fluoride content in the organic and inorganic fractions of enamel,[6] the effect of the addition of fluorides to the water on the solubility of tooth enamel,[7] the re-evaluation of the factors relating to fluoride ion inhibition of acid formation at the tooth surface,[8] a study of the antienzymatic actions of fluoride on oral bacteria as salivary sediment,[9] the rate of dissolution of calcium, phosphorus, magnesium, and carbon dioxide of untreated and fluoride treated dentin.[10] Two methods were described for determining whether an apatite is dominantly hydroxyapatite or dominantly fluorapatite,[11] and a method reported for determination of fluoride in the range of 0.2 to 2.0 ppm in the presence of phosphate concentrations commonly encountered in public water supplies.[12]

Maurice and Schour,[13] in studying the histologic responses of the pulp of the molar of the rat to fillings containing different concentrations of sodium fluoride in a bland base filling material (aquadont), found no significant harm to the pulp within a 32 day period. Weddle and Muhler,[14] by providing growing rats with identical amounts of fluorides at different frequencies throughout the day, found that those ingesting fluoride once a day had more fluoride ions retained in the skeleton than the rats fed similar amounts divided into three feedings per day.

Zipkin and Scow[15] studied the fluoride deposition in the tibia of the young growing rat. By the use of a metal marker (stainless steel pin), they were able to identify new bone immediately distal to the proximal epiphysis and to compare the deposition of fluoride with that in adjacent segments of the diaphysis. The relationship of age to the rate of mobilization of fluoride in a human population group exposed to an excessive amount of water fluoride (8 ppm) was studied by Likens, McClure and Steere.[16] They reported no apparent relation between age and urinary excretion in the groups studied.

USE OF FLUORIDES IN CARIES PREVENTION

Fluorides, at the present, are being utilized in three principal ways to retard dental caries:[17] fluoridation of communal water supplies, topical application to the tooth surface, and by prescription of fluoride for individual use (tablet or solution). For the purpose of observing the effects of fluorides on the prevalence of dental decay, extensive clinical examination of the school populations were begun in 1944 in Brantford, Ontario;[18] Grand Rapids, Mich.;[19] and Newburgh, N. Y.[20] After ten years of fluoridation

4. Matsumiya, S., and others. Electron microscopic studies on the prophylactic effect of the topical application of sodium fluoride on dental caries. Indonesian D. J. 7:19 no. 7, 1956.

5. Brudevold, F., and others. Uptake of tin and fluoride by intact enamel. J.A.D.A. 53:159 Aug. 1956.

6. Peckham, S. C.; Leopold, R. S., and Hess, W. C. Determination of fluoride in organic and inorganic fractions of dentin and enamel. J. D. Res. 35:205 April 1956.

7. Finn, S. B., and DeMarco, C. Effect of artificial water fluoridation on the solubility of tooth enamel. J. D. Res. 35:185 April 1956.

8. Lilienthal, B., and Martin, N. D. Investigations of the anti-enzymatic action of fluoride at the enamel surface. J. D. Res. 35:189 April 1956.

9. Lilienthal, B. Effect of fluoride on acid formation by salivary sediment. J. D. Res. 35:197 April 1956.

10. Burnett, G. W. Influence of fluorides on the rate of dissolution of the principal inorganic elements of dentin. J. D. Res. 35:413 June 1956.

11. Fischer, R. B.; Ring, C. E., and Muhler, J. C. X-ray study of fluorapatite formation during the fluoride treatment of powdered dental enamel. J. D. Res. 35:773 Oct. 1956.

12. Lang, B. G.; Sieverding, O. C., and Borman, E. K. Quantitative determination of fluoride in phosphate-bearing waters. Am. J. Pub. Health 46:860 July 1956.

13. Maurice, C. G., and Schour, I. Effects of sodium fluoride upon the pulp of the rat molar. J. D. Res. 35:69 Feb. 1956.

14. Weddle, D. A., and Muhler, J. C. Frequency of fluoride administration in relation to skeletal storage. J. D. Res. 35:65 Feb. 1956.

15. Zipkin, I., and Scow, R. O. Fluoride deposition in different segments of the tibia of the young growing rat. Am. J. Physiol. 185:81 April 1956.

16. Likens, R. C.; McClure, F. J., and Steere, A. C. Urinary excretion of fluoride following defluoridation of a water supply. Pub. Health Rep. 71:217 March 1956.

17. Dean, H. T. Fluorine in the control of dental caries. J.A.D.A. 52:1 Jan. 1956.

18. Brown, H. K., and others. Brantford-Sarnia-Stratford fluoridation caries study. J. Canad. D. A. 22:207 April 1956.

19. Arnold, F. A., Jr., and others. Effect of fluoridated public water supplies on dental caries prevalence. Pub. Health Rep. 71:652 July 1956.

20. Ast, D. B., and others. Newburgh-Kingston caries-fluorine study. XIV. Combined clinical and roentgenographic dental findings after ten years of fluoride experience. J.A.D.A. 52:314 March 1956.

the three areas reported reductions in dental caries experience rates which are comparable when children of like age groups are studied. The final report of the Newburgh-Kingston study embraces, in addition to the clinical and roentgenographic findings,[20] a short history of the study,[21] pediatric findings after ten years,[22,23] and fluoride metabolism, that is, blood fluoride levels, urinary excretion of fluoride, and magnitude and mechanisms of bone deposition.[24] There were no ill effects of either a medical or dental nature revealed by any of the studies.

Herman[25] has reported findings showing high values of fluoride in urinary calculi when calcium salts were present, and low values of fluoride when no calcium was found.

Arnold and co-workers,[19] in discussing some of the findings in the Grand Rapids-Muskegon study, suggest that fluoridated water might also benefit people of older age groups. This apparently stems from the fact that in the Grand Rapids study, students of 16 years of age showed a reduction of approximately 26 per cent in dental caries experience rates in the permanent teeth after ten years of fluoridation. The question arises whether persons exposed to fluoridated water during their adult life would have the same protection as the 16 year old students, whose initial exposure to fluoridated water was during the sixth and seventh year of life.

Other fluoridation studies in the United States have shown favorable reductions in dental caries experience rates:

1. Evanston, Ill.,[26] after eight and a half years of fluoridation, reported a reduction of approximately 80 per cent in the permanent teeth of the six year age group.

2. Milan, Tenn.,[27] Madison, Wis.,[28] and Maysville, Ky.,[29] after five years of fluoridation, reported favorable reductions in dental decay.

3. Marshall, Texas,[30] completing a ten year survey, reported a 54 per cent reduction in dental decay in children 7 to 15 years of age.

Forrest[31] reported caries experience to be considerably lower in some regions with naturally fluoridated water in England in comparison with caries experience rates of children from regions without fluoride in the water. The incidence and severity of fluoride mottling, however, was directly related to the amount of fluoride in the water. Forrest points out that the term "mottling" is misleading and, in the past, references have been made to mottling as being due solely to fluorides without considering the possibility of other causes.

Peterson and Jordan[32] compared the caries inhibiting value of sodium silicofluoride and sodium fluoride when used topically, and found sodium fluoride to be the better of the two. Bull,[33] in a three year program set up to test the caries-inhibiting properties of topically applied sodium fluoride, reported a reduction of 30 per cent in the incidence of dental

21. Hilleboe, H. E. History of the Newburgh-Kingston caries-fluorine study. J.A.D.A. 52:291 March 1956.

22. Schlesinger, E. R., and others. Newburgh-Kingston caries-fluorine study. XIII. Pediatric findings after ten years. J.A.D.A. 52:296 March 1956.

23. Schlesinger, E. R.; Overton, D. E., and Chase, H. C. Study of children drinking fluoridated and non-fluoridated water. J.A.M.A. 160:21 Jan. 7, 1956.

24. Hodge, H. C. Fluoride metabolism: its significance in water fluoridation. J.A.D.A. 52:307 March 1956.

25. Herman, J. R. Fluorine in urinary tract calculi. Proc. Soc. Exper. Biol. & Med. 91:189 Feb. 1956.

26. Hill, I. N.; Blayney, J. R., and Wolf, W. Evanston dental caries study. XVI. Reduction in dental caries attack rates in children six to eight years old. J.A.D.A. 53:327 Sept. 1956.

27. Trithart, A. H., and Denney, R. P. Study of caries experience rates of six-year-old children of Milan, Tennessee, after five years of fluoridation. J. Tennessee D. A. 36:156 April 1956.

28. Council on Dental Health. Fluoridation program begins for Greater Cleveland residents. A.D.A. Dental Health Highlights 12:28 July 13, 1956.

29. Council on Dental Health. Residents of entire Chicago area now receiving fluoridated water. A.D.A. Dental Health Highlights 12:32 Aug. 10, 1956.

30. Two more studies show fluoridation effective. J.A.D.A. 52:767 June 1956.

31. Forrest, J. R. Caries incidence and enamel defects in areas with different levels of fluoride in the drinking water. British D. J. 100:195 April 17, 1956.

32. Peterson, J. K., and Jordan, W. A. Relative caries-inhibiting value of sodium silicofluoride and sodium fluoride. J. D. Res. 35:54 Feb. 1956.

33. Bull, F. A. Topical application of sodium fluoride to the teeth. Health 13:10 Jan. 1956.

decay found in the deciduous teeth of a kindergarten group.

The Askov, Minn.,[34] dental demonstration, a ten year study applying principles of prevention and control, dental health education and dental care, provides topical application of sodium fluoride annually to children 3, 7, 10, and 13 years of age. In addition to the topical application of sodium fluoride, toothbrushing with an ammoniated dentifrice, a dentifrice containing penicillin, and a stannous fluoride dentifrice have been used on a study basis to evaluate the effect on dental caries.

Muhler, Radike, Nebergall and Day,[35] reported a 50.4 per cent reduction in dental caries on the basis of new decayed, missing and filled surfaces in a group of Indiana University freshmen students after six months' use of a stannous fluoride tooth paste. At the end of one year a 41.6 per cent reduction was reported. Schweinsberger and Muhler[36] found that the routine use of a dentifrice containing stannous fluoride did not significantly increase the urinary fluoride level when comparisons were made with a group of children using dentifrice without fluorides.

Although Switzerland[37] school and health authorities may soon introduce fluorides into communal water supplies, there are many parts or regions in Switzerland where no central water system exists. As a substitute, fluoridated salt, fluoride tablets,[38] and a fluoride tooth paste have been recommended. Because all of the substitutes have disadvantages, a project designed to test the effectiveness of fluorides in pasteurized milk is being studied on a trial basis. The project was commenced in May 1955, and results of the study have not as yet been reported.

ADOPTION OF FLUORIDATION

Attention should be directed to comments concerning fluoridation which appeared in the literature during the past year. It is interesting to note that at least two replies were directed toward statements made by opponents of fluoridation.[39, 40] An excellent source of material for dentists speaking or lecturing to lay groups on fluoridation is an article written by D. B. Williams,[41] a Canadian water works engineer. The article discusses the historical background of fluoridation, the naturally fluoridated water versus water to which fluorides have been added, water works' policy, the chemical, the cost of fluoridation, household water softeners and unfounded fears of fluoridation. A prominent pediatrician, Dr. B. Spock,[42] is heading a committee for the purpose of spurring adoption of fluoridation in a large Eastern city. Approval has been given for the fluoridation of the drinking water at 21 Army posts located in various parts of the United States, Hawaii and Puerto Rico.[43] Assesse-Namur, Belgium,[44] initiated a fluoridation project January 7, 1956. The New Zealand Dental Association[45] publicly pronounced the endorsement of fluoridation. Articles on fluorida-

34. Jordan, W. A., and Peterson, J. K. Askov dental demonstration. North-West Den. 35:30 Jan. 1956.

35. Muhler, J. C., and others. Effect of a stannous fluoride-containing dentifrice on dental caries in adults. J. D. Res. 35:49 Feb. 1956.

36. Schweinsberger, R. A., and Muhler, J. C. Urinary fluorine levels in children following the clinical use of a stannous fluoride-containing dentifrice. J. D. Res. 35:760 Oct. 1956.

37. Ziegler, E. Untersuchungen über die Fluorierung der Milch zur Kariesprophylaxe. Mitt. Naturwiss. Ges., Winterthur 28:3, 1956.

38. Knappwost, A. Zur Fluor-Prophylaxe der Karies: Magnesiumfluorid und Calciumfluorid als physiologische und hochwirksame Kariesprophylaktika. Deut. Med. Wschr. 81:92 Jan. 1956.

39. Hornung, H. Fluoridation: observations of a German professor and public health officer. J.A.D.A. 53:325 Sept. 1956.

40. Hass, R. L. Analysis of assertions on untoward systemic effects of fluorides. Illinois D. J. 25:89 Feb. 1956.

41. Williams, D. B. Fluoridation of drinking water. J. Canad. D. A. 21:665 Dec. 1955.

42. Launch campaign to spur fluoridation. J.A.D.A. 53:106 July 1956.

43. Army posts fluoridate water supplies. Pub. Health Rep. 71:878 Sept. 1956.

44. Council on Dental Health. Fluoridation favored in poll conducted at Hartford, Conn. A.D.A. Dental Health Highlights 12:12 March 9, 1956.

45. Ions in the water. New Zealand D. J. 52:1 Jan. 1956.

tion began in the May issue of the *National Parent-Teacher* magazine.[30] The first article, "How Effective Is Fluoridation?," was written by H. T. Dean, secretary of the American Dental Association Council on Dental Research. More than thirty million persons in 1,426 communities in the United States[46] and some 500,000 persons in 23 Canadian communities[47] are now drinking fluoridated water. Larger cities that have adopted the public health procedure are Chicago, Philadelphia, Baltimore, Washington, D. C., Pittsburgh, Cleveland, Milwaukee, San Francisco, St. Louis and Buffalo.

46. Council on Dental Health. One-fourth of United States population served by public water supplies is now receiving fluoridated water, Public Health Service report shows. A.D.A. Dental Health Highlights 12:41 Nov. 9, 1956.

47. Report indicates fluorides reduce caries in older age groups. A.D.A. News Letter 9:3 Dec. 1, 1956.

PEDODONTICS

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To know what to include in a report designed to cover the research activities in the field of pedodontics is not an easy matter to decide. Pedodontics, being a general practice of dentistry for a limited age group, is interested in and concerned with research in such fields as child growth and development, child psychology, dental materials, pulp therapy and surgery, dental caries and caries preventive methods, preventive orthodontics and operative and prosthodontic technics. Therefore, some of the reviews mentioned in this report also may be included in other reports.

CHILD BEHAVIOR

McReynolds[1] undertook to determine if there was a relation between children's behavior during dental treatment and their parents' attitude toward health. The subjects in the experiment were 50 three to eight year old children taken at random from a private pedodontic practice. The vocation of the children's parents included business, the professions, skilled and unskilled labor. The fathers' mean level of education was one year of college, whereas the twelfth grade was the mean for the mothers. A graduate student in psychology used a list of 16 behavior categories and recorded the children's behavior as manifested in the dental chair during the observation periods of 20 seconds in each minute. Parental health factors were evaluated by using the Cornell Medical Index Health Questionnaire. It is interesting that a positive correlation between parental health attitudes and children's behavior in the dental chair was not confirmed by this study.

GROWTH AND DEVELOPMENT

Where, when and how the body grows and especially the face, cranium and teeth, continue to interest many researchers. Meredith[2] examined 72 white children, age 5 to 11, (36 of each sex) at semiannual intervals so as to study pat-

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1. McReynolds, J. E. Relation of certain aspects of parental health to behavior of the child dental patients. Thesis, University of Nebraska Library, May 1956.

2. Meredith, H. V. Growth in width of the facial skeleton during childhood. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 6.

terns of individual growth in lower face width. He found there were no waves or spurts of growth in face width (bigonial) during this age period. The average increase in bigonial width was 11 mm. for boys and 10 mm. for girls. These increases were practically the same as those for upper face width.

Recently committees of the American Academy of Pedodontics have been interested in determining an average chronological development timetable for teeth. Dentists can no longer think in terms of "average" when considering tooth development or eruption. Sex, race, body build and other factors must be taken into account when compiling tooth development and eruption charts. It was suggested that a grid, similar to those which pediatricians use for determining growth and development, is needed and should be developed. This task is not an easy one, and more data from various areas in the United States are needed.

Noyes, Savara and Dachi[3] reported a study designed to estimate dental calcification age. Full mouth intraoral roentgenograms of children 6 to 12 years of age taken at six month intervals for 3 to 4 years were examined for calcification of the permanent teeth. Each tooth was given a calcification index of 1 to 10, based on the amount of tooth crown and root calcified. Consistent results were reported when the index was applied by different examiners. There was a relation between dental calcification and the chronological age of the children, but the relationship was not consistent. Additional studies are in progress to correlate dental calcification age to height, weight, chest and calf girth and skeletal age.

Many theories have been advanced as to the cause of tooth eruption. Bryer[4] studied the influence of dietary disturbances on the eruptive mechanism of the rat's incisor, and found considerable evidence to support the vascular theory suggested by Constant.[5] Bryer excludes such popular concepts as cellular proliferation, alveolar bone growth and pulpal constriction as the principal factors in the production of the eruptive force. Disturbances in the amount of calcium, phosphorus, vitamin D, fluorine, or a deficiency of protein did not influence the eruptive force or the vascularity whereas vitamin A deficiency, rickets, vitamin D toxicity and cobalt administration resulted in a reduced vascularity and rate of eruption. Bryer concluded that the main eruptive force is derived from tissue tension within the pulp and periodontal tissue, and this tension is dependent on the dynamics of the blood circulation.

Another interesting study pertaining to the influence of vascularity and innervation on resorption of deciduous teeth and eruption of permanent teeth was reported by Miller.[6] The average daily preoperative eruptive rate for the mandibular incisors of the rat was determined to be 0.523 mm. After resection of the common carotid artery, the mandibular nerve and the superior cervical ganglion, the postoperative eruption rates for these groups were 0.445 mm., 0.566 mm., and 0.472 mm. respectively.

ANATOMY AND HISTOLOGY OF DECIDUOUS TEETH

Previous studies have indicated that the enamel rods in the cervical third of the deciduous molars are inclined occlusally from the dentinoenamel junction.

W. C. Rowe[7] has added information to

3. Noyes, H. J.; Savara, B. S., and Dachi, S. F. Studies of growth and development in children; estimation of dental calcification age. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 9.

4. Bryer, L. W. An experimental evaluation of the mechanism of tooth eruption. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 8.

5. Constant, T. E. The eruption of the teeth. Tr., Third International Dental Congress 2:180, 1900.

6. Miller, B. G. Influence of vascularity and innervation on resorption of deciduous teeth and eruption of permanent teeth. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 7.

these reports by measuring the angle of the enamel rods in the cervical third of all deciduous teeth. They also report on the type of cementoenamel junctions found in these teeth. This study showed that the enamel rods in the cervical region of all deciduous tooth surfaces are inclined in an incisal or occlusal direction from the horizontal. The enamel rod angles are different for the various teeth and decrease gradually from the deciduous central incisor (44 degree average) to the deciduous second molar (32 degree average). The angles of the enamel rods in the mandibular teeth are greater than those in the maxillary teeth. There was no correlation between the enamel rod angle and the particular tooth surface. Four types of cementoenamel junctions were reported. The type most frequently observed was cementum and enamel just meeting, followed in frequency by cementum overlapping enamel, a space between cementum and enamel, and enamel overlapping cementum. The latter type was observed in only a few instances and was confined to the maxillary incisors.

The only table of anatomic measurements of the deciduous teeth which has been available is that of Black's which lists only seven average measurements for each tooth. W. S. Kramer's[8] study has provided teachers of dental anatomy with a new table of measurements for the deciduous teeth. Forty-seven measurements were made for each deciduous molar and the averages determined. The seven measurements for the anterior teeth were the same as Black's. In those measurements which could be compared with Black's, the individual variations, although seemingly minor, in the aggregate will be found to produce discernible differences in the appearance of these teeth.

PULP THERAPY

The treatment of pulp exposures in deciduous and young permanent teeth, and the reaction of pulp tissue to various medicaments and filling materials continue to be popular subjects for research.

McDonald[9] combined a clinical and histological study in an attempt to establish criteria for the selection of deciduous teeth suitable for vital pulp therapy. The material consisted of 40 vital deciduous teeth with carious pulp exposures. Roentgenograms and vitality tests were made for each tooth. After the teeth were anesthetized, the rubber dam was applied and all carious tooth structure removed. The appearance and size of the exposure, amount of hemorrhage and presence of any exudate was noted and recorded and the teeth extracted and prepared for sectioning. The conclusions reached were: (1) accurate preoperative diagnosis is essential to the successful outcome in vital pulp therapy for deciduous teeth; (2) pulp tests are not accurate in predicting early pulp inflammation and degenerative changes; (3) pulp capping generally should be limited to mechanical or pinpoint exposures, and (4) pulpotomy is the treatment of choice for carious exposures in deciduous and newly erupted permanent teeth.

Englander, Massler and Carter[10] reported on a clinical study in which a standardized pulpotomy technic was used in 228 teeth which had been scheduled for extraction. The average age of the patients was 21. A paste of zinc oxide and eugenol was placed in all cavities for one to seven days prior to operation. The degenerated pulp tissue was amputated until healthy pulp tissue was reached as

7. Ireland, R. L., and Rowe, W. C. Enamel rod direction and cementoenamel junction in primary teeth. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 34.

8. Kramer, W. S., and Ireland, R. L. Anatomical measurements of primary teeth of man. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 58.

9. McDonald, R. E. Diagnostic aids and vital pulp therapy for deciduous teeth. J.A.D.A. 53:14 July 1956.

10. Englander, H. R.; Massler, M., and Carter, W. J. Clinical evaluation of pulpotomy in young adults. J. Den. Children 23:48 1st Quart. 1956.

evidenced by frank bleeding. A blood clot was allowed to form, then covered with either one of several calcium salts tested, an antibiotic or a paste of zinc oxide-eugenol. The cavities were sealed with a fast-setting zinc oxide and eugenol cement, and the teeth extracted after a period of four days to nine months. The clinical evaluation was based on the presence or absence of postoperative pain; 89 per cent of the instances were considered successful on this basis. The antibiotic group resulted in 20 per cent failures, whereas the calcium salts produced 6 per cent failures. There were no failures with zinc oxide and eugenol. Of the calcium salts tested, calcium hydroxide produced the best results. The authors were of the opinion that the sedation of the pulp and sterilization of dentin prior to pulp amputation, plus careful operative technic, are probably more important to clinical success than the agent used to cover the amputated pulp tissue.

A histologic evaluation of pulpotomies in which various calcium salts and antibiotics were employed as the capping agents was reported by James and Englander.[11] Necrosis and pulpal degeneration were observed in 11 per cent of the specimens, whereas immediately beneath the amputated area in the remaining specimens a mildly inflamed region was observed in 20 per cent, a moderately inflamed region in 50 per cent and a severely inflamed region in 30 per cent. Bridging was found in 35 per cent of the specimens, with 19 per cent showing internal resorption. The teeth in which the calcium salts were used for capping showed a greater incidence of bridging with less internal resorption and less severe inflammation than teeth treated with antibiotics. Pulps capped with an antibiotic combined with a calcium salt showed a reaction similar to that observed under the antibiotics.

11. James, V. E., and Englander, H. R. Response of amputated pulps to calcium salts and antibiotics. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 11.

NEW DRUGS USEFUL IN DENTISTRY

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Since hundreds of articles regarding new drugs appear in the literature annually, and since many of these drugs have potential dental uses, it is obvious that only a small segment of them can be covered in this brief review. Some new developments concerning drugs in use prior to 1956 are also reviewed.

ATARAXICS

The so-called "tranquilizing" drugs or ataraxics have caught the public's fancy because of wide publicity in lay magazines. It is possible that they may serve a useful purpose in dentistry for premedication and as an adjunct to pain control.

Ataraxics are drugs which alleviate anxiety, tension, apprehension, and agitation and which produce a state of tranquility. They do not produce any extensive depression of mental faculties or consciousness. Thus, they would appear to be ideal for premedication of the dental patient, but it is becoming evident that they have unpredictable and often serious side effects.

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The member of this group most frequently used in dentistry up to this time is chlorpromazine (Thorazine). It is stated that some 4,000 articles have appeared in the European and American literature concerning this one drug alone. One of the best reviews this writer has seen is that by Dobkin, Gilbert and Melville.[1] After reviewing nearly 100 articles and reporting extensive research of their own, these observers report, "Studies indicate that chlorpromazine has numerous pharmacological attributes of value in premedication for clinical anesthesia." However, they noted certain potential side effects. They state that large doses induce orthostatic hypotension on the cardiovascular system and that therapeutic doses cause transient sinus arrhythmias and tachycardia. They further state that the side effect of vasopressor drugs on cardiovascular homeostasis in dogs and in man after chlorpromazine premedication is such that much larger doses of the peripheral acting vasopressors are required to correct hypotension.

Chlorpromazine has been observed to potentiate the activity of analgesics and hypnotics.[2,3] Hoffman[4] has recently reported on the application of this action in dentistry. In a double blind study, 178 patients who underwent oral surgical procedures received 25 mg. tablets of chlorpromazine twice daily, whereas 103 patients received an identical appearing placebo tablet twice daily. The treated patients required significantly less of an aspirin-phenacetin-caffeine compound to keep them comfortable as compared to the control group, and 23 patients in the control group required a narcotic (codeine) in addition to the aspirin-phenacetin-caffeine, whereas none of the treated group required additional medication.

Hoffman noted no untoward effects from the chlorpromazine in the group of 178 patients. Numerous toxic effects have been reported, however, when the drug is used over a longer period. Agranulocytosis[5] and jaundice[6] have been reported following its use. The Council on Pharmacy and Chemistry of the American Medical Association[7] warned that chlorpromazine ". . . should be given with extreme caution to patients with arteriosclerosis, cardiovascular disease, or other conditions in which a sudden drop in blood pressure may be undesirable" and that "because of its potentiating action with many other drugs, chlorpromazine hydrochloride should be used with caution in conjunction with other agents, particularly barbiturates, narcotics, and general anesthetics." This reviewer would have to agree with the Council's conclusion on chlorpromazine that "although its therapeutic range of effectiveness is wide, sufficient experience has not been gained to determine its ultimate place in the therapeutic armamentarium."[7]

Although very little has appeared in the dental literature, meprobamate (Miltown, Equanil) is being used in the dental field to a limited degree. Earlier reports indicated a low order of toxicity for this drug,[8] but more recently reports of significant toxic effects have appeared in the literature.[9] Severe diarrhea and various severe skin reactions have been seen and in some instances occurred after a single dose. In a few instances excitement rather

1. Dobkin, A. B.; Gilbert, R. G. B., and Melville, K. I. Chlorpromazine: review and investigation as a premedicant in anesthesia. Anesthesiology 17:135 Jan. 1956.

2. Sadove, M. S., and others. Chlorpromazine and narcotics in the management of pain of malignant lesions. J.A.M.A. 155:626 June 12, 1954.

3. Wallis, R. Potentiation of hypnotics and analgesics: clinical experience with chlorpromazine. New York M. J. 55:243 Jan. 15, 1955.

4. Hoffman, M. H. Chlorpromazine in the relief of pain after oral surgery. J.A.D.A. 53:555 Nov. 1956.

5. Lomas, J. Chlorpromazine and agranulocytosis. Brit. M. J. 4883:358 Aug. 7, 1954.

6. Hodges, H. H., and LaZerte, G. D. Jaundice and agranulocytosis with fatality following chlorpromazine therapy. J.A.M.A. 158:114 May 14, 1955.

7. American Medical Association. Council on Pharmacy and Chemistry. New and nonofficial remedies. Philadelphia, J. B. Lippincott Co., 1956.

8. Borrus, J. C. Study of effect of Miltown (2-methyl-2-N-propyl-1, 3-propanediol dicarbamate) on psychiatric states. J.A.M.A. 157:1596 April 30, 1955.

9. Friedman, H. T., and Marmelzat, W. L. Adverse reactions to meprobamate. J.A.M.A. 162:628 Oct. 13, 1956.

than tranquilization followed meprobamate medication.

In concluding this brief review of the current status of the tranquilizing drugs in dentistry, it is well to remember that chlorpromazine and meprobamate are only two of the many drugs belonging to this group. Much further study will be required before their area of usefulness in dentistry can be defined and the most effective and safe members of the group determined. In the meantime dentists would be well advised to approach the use of this group with caution.

ANTIBIOTICS

Possibly of more importance in the field of dentistry than the introduction of new antibiotics are certain developments regarding older antibiotics during the past year. It has become increasingly apparent that the topical use of penicillin is both dangerous and rarely essential in dental therapy.[10]

Jawetz[11] has called attention to the serious abuse of antibiotics in both dentistry and medicine and states that from 4 to 15 per cent of patients now exhibit sensitivity reactions to penicillin. He further points out that indiscriminate use of antibiotics can unnecessarily produce: (1) direct drug toxicity in the patient, (2) hypersensitivity reactions, (3) alteration in microbial flora and superinfection, (4) masking of serious disease and (5) bacterial resistance. In view of these hazards and the increasing evidence that topical use of penicillin is rarely necessary in dentistry, the Council on Dental Therapeutics has deleted all topical dosage forms of penicillin from *Accepted Dental Remedies*.[12] If topical antibiotic therapy is to be used in the treatment of Vincent's infection, it would appear advisable to use preparations of bacitracin, gramicidin or polymyxin or all three since the hazards of sensitivity reactions are much less with these agents than with penicillin.[13] It should be emphasized, however, that further study is needed to clarify the effectiveness of these agents in Vincent's infection.

Another important development in dental antibiotic therapy is the increasing use of orally administered penicillin. This development has been encouraged by the introduction of newer types of penicillin which are more reliably absorbed from the gastrointestinal tract, plus the realization that there is less danger of anaphylaxis as well as other reactions from penicillin given orally than when it is administered parenterally.[14-16] Perhaps the most promising form of penicillin for oral administration is phenoxymethyl penicillin (penicillin V). This form of penicillin appears to have several significant advantages:

1. It is relatively stable in the presence of acid and therefore is not so readily inactivated by the acid of the stomach.

2. Although only slightly soluble in acid medium, it becomes readily soluble at neutral or alkaline pH and therefore will become readily absorbable in the upper intestinal tract.

3. Reports indicate higher and more prolonged blood levels are attained when phenoxymethyl penicillin is administered orally as compared with similar doses of penicillin G.[17-20] Clinical use of phenoxymethyl penicillin has produced good results.[19, 20]

10. Gibson, C. F., Jr., and Knighton, H. T. Status of local antibiotic therapy in dental infections, with particular reference to penicillin. J.A.D.A. 53:64 July 1956.

11. Jawetz, Ernest. Rational use of antimicrobial agents. Reason versus emotion in chemotherapy. Oral Surg., Oral Med. & Oral Path. 8:982 Sept. 1955.

12. American Dental Association. Council on Dental Therapeutics. Council reports on topical dosage forms of penicillin. J.A.D.A. 53:66 July 1956.

13. Kutscher, A. H.; Budowsky, J., and Chilton, N. Reactions following the use of bacitracin, tyrothricin gramicidin and polymyxin B troches; a controlled study. J. Allergy 25:46 Jan. 1954.

14. White, C. B. Reactions to penicillin given orally in mass prophylaxis. U. S. Armed Forces M. J. 4:1606 Nov. 1953.

15. Keefer, C. S. Evaluation, antibiotic therapy. Postgrad. Med. 9:101 Feb. 1951.

16. Babione, R. W. Penicillin reaction rates in relation to penicillin dosage in the Navy. Antibiotic Med. & Clin. Therap. 3:388 Nov. 1956.

The introduction of the new antibiotic, nystatin (Mycostatin), may have significance in dentistry in the treatment of oral moniliasis (thrush).[7,21,22] Nystatin appears to be effective *in vitro* against a number of fungus organisms, but its clinical effectiveness seems established only for *Candida albicans*.

It should be emphasized that a number of new antibiotics are now in early clinical trial; but since their value in dentistry seems doubtful, they are not reviewed here.

LOCAL ANESTHETICS

A promising new agent for topical anesthesia is now being used experimentally in both medicine and dentistry. Dyclonine hydrochloride (Dyclone) has been used successfully in medicine for such procedures as endotracheal intubation and laryngoscopy. It has a low order of toxicity and can be used in 1 per cent concentration as a mouthwash or gargle.[23] Much additional work will be necessary to clarify its position in dental anesthesia, but it seems possible that it may have value as a topical anesthetic for use before taking impressions or roentgenograms in the mouths of patients with unusually active gag reflexes. It should not be injected.

Every dentist who uses local anesthesia or general anesthesia should read the article on resuscitation by Sadove and Wyant which appeared in the August 1956 issue of THE JOURNAL.[24] Space will not permit a review of this article here, but suffice to say it gives an up-to-date and very understandable review of measures to be taken as a result of syncope or reactions to anesthetics.

MUSCLE RELAXANTS

The dentist who must work in the mouth of a spastic patient always faces a difficult problem. Mephenesin has been of some help in these instances but is far from uniformly successful. A new muscle relaxant, zoxazolamine (Flexin), appears to have advantages over mephenesin especially when potentiated with chlorpromazine.[25,26] Much additional evaluation will be necessary to determine its degree of usefulness in dentistry, but early studies indicate that it deserves a trial in the hands of well-trained clinical investigators.

ANTIHISTAMINES

Work reported in 1956 seems to cast doubt on the early enthusiasm for antihistaminic drugs in the reduction of postsurgical sequelae in dentistry. A double blind study involving 500 patients failed to show any reduction in postoperative pain, swelling, trismus, or hemorrhage in the patients receiving antihistamines as compared to those receiving a placebo.[27]

A well-controlled cooperative study by the department of internal medicine, the department of public health statistics and the health service at the University of Michigan has also cast doubt on the in-

17. Wright, W. W., and others. Serum concentrations and urinary excretion following oral administration of penicillin V and comparison with penicillin G. Antibiotic Med. 1:490 Sept. 1955.

18. Martin, W. J.; Nichols, D. R., and Heilman, F. R. Penicillin V, a new type of penicillin: preliminary clinical and laboratory observations. Proc. Mayo Clin. 30:467 Oct. 19, 1955.

19. Quinn, E. L., and others. Phenoxymethyl penicillin (penicillin V) therapy of subacute bacterial endocarditis. J.A.M.A. 160:931 March 17, 1956.

20. Martin, W. J.; Nichols, D. R., and Heilman, F. R. Observations on clinical use of phenoxymethyl penicillin (penicillin V). J.A.M.A. 160:928 March 17, 1956.

21. Stovall, V. S., and others. Treatment of thrush with Mycostatin. Texas J. Med. 52:474 July 1956.

22. Welch, Henry. Place of nystatin in chemotherapy. Antibiotic Med. 2:79 Feb. 1956.

23. Harris, LeRoy C., Jr.; Parry, J. C., and Greifenstein, F. E. Dyclonine—a new local anesthetic agent: clinical evaluation. Anesthesiology 17:648 Sept.-Oct. 1956.

24. Sadove, M. S., and Wyant, G. M. Principles of resuscitation in the dental office. J.A.D.A. 53:168 Aug. 1956.

25. Amols, William. Clinical experience with a new muscle relaxant, Zoxazolamine. J.A.M.A. 160:742 March 3, 1956.

26. Smith, R. T., and others. Zoxazolamine (Flexin) in rheumatic diseases. J.A.M.A. 160:745 March 3, 1956.

27. Szmyd, Lucian. Clinical evaluation of an antihistaminic preparation in oral surgery. Oral Surg., Oral Med. & Oral Path. 9:928 Sept. 1956.

ference contained in a number of previous publications that virtually all penicillin reactions can be eliminated by means of antihistamine medication. This study showed a statistically significant reduction in urticarial reactions but ". . . failed to show that an oral and/or parenterally administered antihistamine produced any significant effect on the incidence of delayed or severe penicillin reactions. . . ." These findings are what might be expected on the basis of the known pharmacologic characteristics of antihistamines.[28]

CONCLUSION

It should be emphasized that the previously mentioned new drugs and new developments regarding older drugs constitute only a fraction of the recent studies in drug therapy. In the opinion of the writer, however, they are the developments which are most significant to dentistry and will find earliest application in dental therapeutics.

28. Matthews, K. P., and others. A controlled study on the use of parenteral and oral antihistamines in preventing penicillin reactions. J. Allergy 27:1 Jan. 1956.

RESEARCH ON DENTAL MATERIALS AND INSTRUMENTATION IN 1956

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A review[1] of the developments in dental materials and instruments in the five years 1951-1955, shows important advances in amalgam, rubber-base impression materials, plastic teeth, zinc oxide-eugenol pastes and in methods of cutting enamel and dentin. These advances carried over into 1956.

The antibacterial action of restorative materials was studied by Shay, Allen and Mantz[2] using eight agar mediums and three organisms. The diameter of the zone of inhibition of growth in the agar plates rated the materials from the most to the least effective in the following order: copper amalgam, copper cement, gold foil, zinc phosphate cement, silver amalgam, silicate cement and inlay gold, and direct filling resin.

It would be interesting to compare these laboratory tests with the recurrence of decay about different kinds of fillings. Certainly the anticariogenic action of a filling material is an important consideration, especially so since the old idea that filling materials hermetically seal cavities has been abandoned.

Additional evidence is presented by Crawford and Larson[3] that severe leakages occur. They observed the penetration of a calcium chloride solution containing radiocalcium between amalgam fillings or gold inlays and cavity surfaces. These observations were made in autoradiographs of sections of 12 extracted teeth that contained the fillings at the time of extraction.

Five teachers and clinicians and five experts in dental materials evaluated gold foil, silicate cement, and direct filling

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1. Paffenbarger, Geo. C. Dental materials and instruments 1951-55. Internat. D. J. 6:299 Sept. 1956.

2. Shay, D. E.; Allen, T. J., and Mantz, R. F. Antibacterial effects of some dental restorative materials. J. D. Res. 35:25 Feb. 1956.

3. Crawford, W. H., and Larson, Jeanne H. Fluid penetration between fillings and teeth using Ca^{45}. J. D. Res. 35:518 Aug. 1956.

resins, using estimations of the extent to which they approached the ideal filling material so far as health, function, cavity seal, technic, and esthetics were concerned. Stebner's[4] tabulation of these estimations gave gold foil 80.5 per cent of the ideal, silicate 60.5 per cent, and direct filling resin 47.0 per cent.

METALLIC MATERIALS

Phillips and Leonard[5] found little abrasion of enamel caused by clasps made of different alloys.

A test for determining the setting time of amalgam that would correlate well with carvability was perfected by Taylor and Margetis.[6] This test is based on the load required to punch a hole in an amalgam disk at various times from beginning the mix. When the load reaches a constant value, the amalgam has set.

The metal gallium is fluid at 86° F. This melting point can be depressed to 59° F. by adding 11 per cent of tin. Using gallium or the gallium-tin eutectic as the liquid component, Smith and Caul[7,8] made alloys that were plastic and would then harden at room temperature like dental amalgam. Some alloys had good properties. Bioassays are to be done.

CERAMIC MATERIALS

Peyton, Mahler and Asgar[9] employed a hygroscopic investment and designed a casting technic in which the dimensions of the mold are changed by the addition of specific amounts of water to the partially set investment surrounding the wax pattern.

The cause of the large setting expansion that occurs on the sorption of water by investment was the subject of several researches. In Australia, Docking[10] found that if the setting expansion was large, the hygroscopic expansion was large and the reverse. He and Donnison[11] found that the largest expanding investments were also the strongest. Ryge and Fairhurst[12] postulated a physical mechanism of hygroscopic expansion based on the absorption of liquids into the investment during hydration of the calcined gypsum and not on further hydration.

Martin[13] demonstrated the relation between the fit of a casting and the powder-liquid ratio of the investment.

Crystalline phases of zinc phosphate cement after setting were identified by Iiyama,[14] using roentgen-ray diffraction methods. The set cement is composed of zinc oxide (ZnO), tertiary zinc phosphate ($Zn_3(PO_4)_2 \cdot 4H_2O$) and a small amount of magnesium oxide. Crystals of zinc monohydrogen phosphate ($ZnHPO_4 \cdot 3H_2O$), which were considered to exist in set cement by previous investigators, were not detected.

The thermal conductivity of zinc phosphate cement was slightly more than that of dentin as determined by Phillips and associates.[15]

4. Stebner, Charles M. Role and evaluation of gold foil, silicate cement and acrylic resins in operative dentistry. J.A.D.A. 53:661 Dec. 1956.

5. Phillips, Ralph, and Leonard, Leo J. A study of enamel abrasion as related to partial denture clasps. J. Pros. Den. 6:657 Sept. 1956.

6. Taylor, D. F., and Margetis, P. M. A method for measurement of the setting time of dental amalgam. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 81.

7. Smith, Denton L., and Caul, Harold J. Alloys of gallium with powdered metals as possible replacement for dental amalgam. J.A.D.A. 53:315 Sept. 1956.

8. Smith, Denton L.; Caul, Harold J., and Sweeney, W. T. Some physical properties of gallium-copper-tin alloys. J.A.D.A. 53:677 Dec. 1956.

9. Peyton, F. A.; Mahler, D. B., and Asgar, Kamal. Controlled water addition technic for hygroscopic expansion of dental casting investment. J.A.D.A. 52:155 Feb. 1956.

10. Docking, A. R. Relation of hygroscopic to normal setting expansion of investments. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 82.

11. Donnison, J. A., and Docking, A. R. Effect of surface area on the hygroscopic setting expansion and strength of investments. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 83.

12. Ryge, Gunnar, and Fairhurst, Carl W. Hygroscopic expansion. J. D. Res. 35:499 Aug. 1956.

13. Martin, K. H. An investigation of the effect of the water-powder ratio on the accuracy of the fit of gold alloy castings. Austral. D. J. 1:202 Aug. 1956.

14. Iiyama, Toshimichi. Crystalline phases in zinc phosphate cement after setting. Reports of the Research Institute of Dental Materials, Tokyo Medical and Dental University 5:13, 1956.

The accuracy of indirect dies was measured by Fusayama,[16] who found hydrocal to be the most accurate die material. Both modeling compound and the alginates were in the same range of accuracy for impressions.

ORGANIC MATERIALS

Matthews and Wain,[17] using resistance strain gauges, showed that the maximum tensile stress in an artificial complete upper denture under load was on the palate.

The increase in volume on sorption of water of artificial dentures having an acrylic resin base resulted in an increase in the retention of the denture in the mouth. From the viewpoint of retention, an exact duplication of an artificial denture appears to Campbell[18] to be impossible.

Smith and Bains[19] examined the various methods for determining residual monomer in polymethyl methacrylate. They found a modified bromination procedure best quantitatively. One part of the residual monomer is extractable by water and the other is not. The water extractable portion is leached out so rapidly that it could hardly be considered as the cause of denture sore mouth.

The resin cement and posterior direct filling resins shrank on hardening, expanded on sorption of water, were relatively insoluble, and could be made as radiopaque as zinc phosphate cements or as optically translucent as enamel and dentin. They had about the same compressive strength as the zinc phosphate cements, did not adhere to the hard tooth tissues under oral conditions, and were not color stable.[20] Some resin cements had extremely thin film thickness. The resin cements have not replaced zinc phosphate cements because the resin cements have a short working time and the excess set cement is difficult to remove from interproximal spaces and from underneath the free margin of the gingiva. Langeland[21] found that the resin cements seem to be about as irritating to the pulp as the direct filling resins.

Japanese investigators[22] preferred the brush-on technic of placing the direct resin fillings. It gave the best adaptation and minimized porosity.

Dolder[23] believes that the poor margins and the discolorations are the primary faults that prevent the resins from displacing the silicate cements.

The bonding of a resin to tooth tissues is decreased on immersion in water. Buonocore[24] reports this is due to the plasticizing action of water on dentin, on the resin or on both.

Alginate impressions did not change appreciably when stored in liquid petrolatum according to Morrant and Elphicke.[25] Skinner and Hoblit[26] report that the alginate and agar types of hydrocolloidal impression materials have about equal accuracy.

15. Phillips, R. W.; Johnson, R. J., and Phillips, L. J. An improved method for measuring the coefficient of thermal conductivity of dental cement. J.A.D.A. 53:577 Nov. 1956.

16. Fusayama, Takao; Yoshizawa, Katsumi, and Kurosu, Kazuo. Accuracy and hardness of indirect inlay dies. Bull. Tokyo Medical and Dental University 2:199 Jan. 1956.

17. Matthews, E., and Wain, E. A. Stresses in denture bases. Brit. D. J. 100:167 April 3, 1956.

18. Campbell, R. L. Effects of water sorption on retention of acrylic resin denture bases. J.A.D.A. 52:448 April 1956.

19. Smith, D. C., and Bains, M. E. D. Detection and estimation of residual monomer in polymethyl methacrylate. J. D. Res. 35:16 Feb. 1956.

20. Schouboe, P. J.; Paffenbarger, G. C., and Sweeney, W. T. Resin cements and posterior-type direct filling resins J.A.D.A. 52:584 May 1956.

21. Langeland, K. Pulp reactions to resin cements. Acta Odont. Scandinavica 13:239 Feb. 1956.

22. Fusayama, Takao; Ishibashi, Masumi, and Kitazaki, Takao. Comparison of technics for direct acrylic resins. Bull. Tokyo Medical and Dental University 2:235 Jan. 1956.

23. Dolder, E. Physikalische Eigenschaften des Silikatzements und des schnellhärtenden Kunststoffs. Schweiz. Mschr. Zahnhk. 66:860 Sept. 1956.

24. Buonocore, M. G. Additional observations on the bonding properties of an adhesive resin composition. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 85.

25. Morrant, G. A., and Elphicke, G. B. Investigation into methods for maintaining the dimensional stability of alginate impression materials. Brit. D. J. 100:42 Jan. 17, 1956.

26. Skinner, Eugene W., and Hoblit, Noel E. A study of the accuracy of hydrocolloid impressions. J. Pros. Den. 6:80 Jan. 1956.

Fairhurst and associates[27] showed that the optimum elastic behavior of seven rubber-base impression materials was developed after the time of set specified by the manufacturer. At least ten minutes should elapse from the beginning of the mix until withdrawal of the impression.

Spreter von Kreudenstein and Monn,[28] using the radioisotope P^{32} in solution, showed that a rosin-containing material effectively sealed the root canal; zinc phosphate cement did not.

Fedi and Rau[29] outlined an excellent technic for making vinyl resin models.

INSTRUMENTATION

Actual loads on single molars during mastication of various foods were determined on two subjects by Anderson[30] with a small resistant strain gauge mounted in an inlay. Average maximum loads measured on 20 sequences of chewing ranged from 15.8 to 32.8 pounds, depending on the food material and the individual.

Henry[31] reported on the effect of design on performance of burs, using the average distance that the bur advanced in brass and Ivorene per revolution of the bur as the criterion. A better finish of the flutes resulted in a slight increase in cutting efficiency but not sufficient to warrant the extra cost. Burs with five or six flutes cut slightly better than those with seven or eight. Only a few millionths of an inch of the bur blade is used in cutting hard substances.

Stewart and Stephens[32] designed an inverted cone diamond instrument with a noncutting shoulder that regulates the depth of cut. The shoulder is a safeguard against the exposure of pulp in deciduous teeth.

A number of favorable reports based on histological studies[33-36] have appeared in 1956 regarding the safety of ultrasonics in cavity preparation as far as response to the pulp in mature teeth is concerned. The response to the ultrasonic method of cutting the continuously growing incisors of guinea pigs was much more harmful than the conventional rotary methods on both enamel and dentin formation.[37]

Since the release of the two reports, *The Biological Effects of Atomic Radiation*[38, 39] (and their interpretation by newspapers and radio commentators), there has been an increasing awareness by the laity of the potential harm from roentgen ray radiation used in diagnosis. In some instances patients have refused to have the necessary roentgenograms made. Some people incorrectly interpreted these reports[38, 39] as meaning that if one had two dental roentgenograms made, then the "permissible" 10 roentgen limit to the gonads for the period of life up to the end of the reproductive period had been used up.

As the reports[38, 39] point out, the health professions must reduce the exposure to roentgen ray radiation to as low a degree

27. Fairhurst, C. W., and others. Elastic properties of rubber base impression materials. J. Pros. Den. 6:534 July 1956.

28. Spreter v. Kreudenstein, Th., and Monn, W. Weitere Untersuchungen mit P^{32} über die Flüssigkeitspassage in gefüllten und nichtgefüllten Wurzelkanälen. Deut. Zahnärztl. Zschr. 11:1081 Sept. 15, 1956.

29. Fedi, P. F., Jr., and Rau, C. F. The technic of fabricating vinyl resin molds. U. S. Armed Forces M. J. 7:544 April 1956.

30. Anderson, D. J. Measurement of stress in mastication II. J. D. Res. 35:671 Oct. 1956.

31. Henry, E. E. The influence of design factors on the performance of the inverted cone bur. J. D. Res. 35:704 Oct. 1956.

32. Stewart, D. J., and Stephens, R. R. Diamond instruments designed for deciduous molar cavity preparation. Brit. D. J. 101:107 Aug. 21, 1956.

33. Zach, L., and Brown, G. N. Pulpal effect of ultrasonic cavity preparation, preliminary report. New York D. J. 22:9 Jan. 1956.

34. Butt, Byron, G., and others. Histopathological evaluation of pulpal response to ultrasonic cavity preparation. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 13.

35. Friedman, Joel; Lite, Theodore, and Solomon, Harold. Pulp reactions to ultrasonic tooth preparation. New York J. Den. 26:144 March 1956.

36. Healey, Harry J.; Patterson, Samuel S., and Van Huysen, Grant. Pulp reaction to ultrasonic cavity preparation. U. S. Armed Forces M. J. 7:685 May 1956.

37. Hansen, L. S., and Nielsen, A. G. Comparison of tissue response to rotary and ultrasonic dental cutting procedures. J.A.D.A. 52:131 Feb. 1956.

38. The biological effects of atomic radiation. Summary reports. Washington, D. C., U. S. National Academy of Sciences, National Research Council, 1956.

39. The biological effects of atomic radiation. A report to the public. Washington, D. C., U. S. National Academy of Sciences, National Research Council, 1956.

as possible consistent with the health of the patient.

Etter,[40] like many others before him, has pointed out that radiation in dental roentgenographic examinations can be materially reduced by employing higher kilovoltages, longer target-film distances, shorter time exposures, faster film, and more adequate filtration than is customarily employed. By proper diaphragming, the useful roentgen ray beam should strike as small an area as is consistent with practicable use.

Budowsky and associates[41] measured the radiation exposure on 40 individuals who had a 14-film full-mouth roentgenographic examination, employing 65 kilovolt peak, 10 milliamperes, an 8-inch target-film distance, a field 4⅛ inches in diameter, and 0.5 mm. inherent aluminum filtration. The total exposure time was 41 seconds.

The average radiation to the skin ran from a high of 76.9 roentgens in the upper bicuspid to a low of 55.4 roentgens in the upper molar area. In the lower abdominal area it was 0.45 roentgen. The authors pointed out the possible hazards in dental roentgenographic procedures, and thought the use of a protective apron on the patient might be indicated as suggested formerly by Nolan.

Hudson and Kumpula[42] designed a panoramic x-ray machine that produces full-mouth roentgenograms on a single 5 by 10-inch film; an extraoral technic is used. The machine, constructed at the National Bureau of Standards in cooperation with the Air Force, has had a large-scale trial, which showed that it is practicable.

If the users of x-ray equipment do not take the necessary precautions to protect workers and patients, then regulation of radiation exposure will be by legislative means. It is recommended, therefore, that every dentist who uses or supervises the use of x-ray equipment read the National Academy of Science reports,[38, 39] National Bureau of Standards Handbook 60 on *X-ray Protection*,[43] and the British Medical Research Council's report on *Hazards to Man of Nuclear and Allied Radiation*.[44]

40. Etter, L. E. Radiation dose reduction by higher voltage dental roentgenography. J.A.D.A. 53:305 Sept. 1956.

41. Budowsky, Jack, and others. Radiation exposure to the head and abdomen during oral roentgenography. J.A.D.A. 52:555 May 1956.

42. Hudson, D. C.; Kumpula, J. W., and Dickson, George. A panoramic x-ray dental machine. U. S. Armed Forces M. J. 8:46 Jan. 1957.

43. X-ray protection. National Bureau of Standards Handbook 60. Washington, D. C., Government Printing Office, 1955.

44. British Medical Research Council. Hazards to man of nuclear and allied radiations. Cmd. 9780. London, Her Majesty's Stationery Office, 1956.

SOME RECENT DEVELOPMENTS IN THE COMPOSITION AND PHYSIOLOGY OF HUMAN SALIVA

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Evidence is accumulating of the importance of saliva for the preservation of the health of the soft and hard tissues of the oral cavity. As knowledge of its composition increases, saliva appears to be as complex as other body fluids such as blood, and to present even more difficulties to investigators.

With the development of methods of obtaining the individual secretions, many of the problems are eliminated. The Carlson-Crittenden-Lashley parotid cup makes the collection of the parotid secre-

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tion convenient, and increasing use has been made of it. The Schneyer-Pickerill mandibular segregator provides a satisfactory means of collecting individual submaxillary and sublingual secretions from human beings, but appliances must be constructed for each individual. The parotid cup has also been used for preliminary studies of the secretion of the mucosal glands of the oral cavity.[1]

RATE OF FLOW OF SECRETIONS

The improvements in the methods of collection have made possible improved estimates of the rate of flow of the separate secretions and of the contribution made from the different sources. For the average "resting" secretion of man, 69 per cent seems to be derived from the submaxillary glands, 26 per cent from the parotid glands and 5 per cent from the sublingual glands;[1] the minor mucosal glands do not contribute significantly.

The understanding and control of the stimulatory effects in relation to the rate and composition of saliva are still basically unsolved problems of major magnitude in studies of saliva, although important contributions have been made recently. Measurements of the flow of the individual secretions indicate that the glands do not secrete during sleep and that so-called "resting" or "unstimulated" salivas really represent secretions in response to low exogenous stimulation.[2]

When chemical stimulation of the tongue is used, the relative contribution of the three major gland pairs is about the same as for "resting" saliva, but some evidence exists that the submaxillary glands may contribute a greater proportion as the intensity of the stimulation increases.[3]

The chewing of flavored chicle, replaced frequently with new samples, is recommended as giving satisfactory constancy to parotid flow.[4] The right and left glands of each individual exhibited similar rates of flow, but the concentrations of some constituents were found to vary in the gland pairs. Similar results were noted with respect to the time of collection. Diets rich in carbohydrates were reported to influence the composition of the saliva and the relative contributions of the major salivary glands.[5]

COMPOSITION OF SALIVA

Although still limited, the knowledge of the principal component of salivas, the protein fraction, has advanced. The so-called "mucin" appears now to be a product of analysis rather than an actual component of salivary secretions; it is a material precipitated from saliva (and other secretions) by weak acids.[6] The components of "mucin" seem to be dissociated in the original saliva. They or "mucin" are, however, related to many of the physical properties of saliva, especially the viscosity and *Spinnbarkeit*.[7,8] "Mucin" also coagulates when saliva or the submaxillary or sublingual secretion is frozen,[9] and may be lost if the saliva or secretions are kept at room temperature for an hour.

Electrophoresis and ultracentrifugation have been powerful tools for the study of body fluids, especially blood. Their application to the individual salivary secretions

1. Schneyer, L. H. Source of resting total mixed saliva of man. J. Applied Physiol. 9:79 July 1956.

2. Schneyer, L. H., and others. Rate of flow of human parotid, sublingual, and submaxillary secretions during sleep. J. D. Res. 35:109 Feb. 1956.

3. Schneyer, L. H., and Levin, L. K. Rate of secretion by exogenously stimulated salivary gland pairs of man. J. Applied Physiol. 7:609 May 1955.

4. Chauncey, H. H.; Weiss, P. A., and Lisanti, V. F. Parotid salivary components under various conditions of stimulation. (Abst.) J. Am. Col. Den. 23:188 June 1956.

5. Gore, J. T. Factors influencing the physical and chemical properties of saliva. J. D. Res. 35:102 Feb. 1956.

6. The carbohydrates, Pigman, Ward, editor. Academic Press, New York, 1957.

7. Dewar, M. R., and Parfitt, G. J. Mucin content, physical properties of saliva and caries activity. J. D. Res. 33:751 Dec. 1954.

8. Dewar, M. R., and Parfitt, G. J. Investigation of the physical properties of saliva and their relationship to the mucin content. J. D. Res. 33:596 Oct. 1954.

9. Schneyer, L. H. Coagulation of salivary mucoid by freezing and thawing of saliva. Proc. Soc. Exper. Biol. & Med. 91:565 April 1956.

and whole salivas has demonstrated the high degree of complexity and variability of the human salivary secretions.[10-14] Some basic proteins are present, and no evidence for a "mucin" exists in the patterns at pH 8.6, under conditions similar to those used for blood analysis. Because of the high degree of dilution of the salivary constituents, concentration is necessary before analysis; for this purpose, dialysis against polyvinylpyrrolidone solutions at low temperatures seems to be suitable. The ultraviolet absorption of whole saliva seems to arise mainly from the protein components.[15]

The enzymes of human saliva and oral secretions[16] have been studied additionally, and several new ones have been described. The enzymes studied include the proteolytic enzymes of whole saliva and parotid secretion,[17] lipase,[18,19] poliomyelitis receptor-destroying enzyme,[20] alkaline and acid phosphatase,[21] esterases[22] (localized in gland sections of oral tissues from several animals and man), and lysozyme in parotid and submaxillolingual secretions.[23] The lysozyme concentration is greatest in the submaxillolingual secretion and was not identical in paired parotid glands.

The important problem of the origin of salivary enzymes has received some additional attention from the standpoint of the peroxidases.[24] The salivary peroxidase appears to be derived from several sources, which include the major secretions and the leukocytes of the myeloid series. Salivary peroxidase did not seem to resemble known bacterial peroxidase or hemoglobin.

Acid and alkaline phosphatases, esterase, cholinesterase, sulfatase, lipase, beta galactosidase, beta glucuronidase, hyaluronidase and lysozyme were measured in a large number of whole salivas. Acid phosphatase, esterase, cholinesterase, lipase, beta glucuronidase and lysozyme were found in human parotid secretion.[25] Most of these enzymes were shown to be produced by the oral flora, and they seem to be of both exogenous and endogenous origin in whole saliva.

The cholinesterase activity of parotid saliva has assumed particular importance as a possible measure of "psychological stress" as distinguished from "physiological stress."[26] Both anticipation of "stress" and actual "stress" produced a statistically significant depression of the activity of this enzyme.

The amino acid composition of crystalline human salivary amylase has been determined and further information about its stability and activation obtained.[27,28] Aspartic acid comprises about

10. Patton, J. Reid. The carbohydrates and proteins of human saliva. Thesis, University of Alabama, 1956.

11. Reid, J., and Pigman, W. Electrophoretic and ultracentrifugal studies of human saliva. (Abst.) J. Am. Col. Den. 23:192 June 1956.

12. Pigman, W., and Patton, J. R. Electrophoretic and ultracentrifugal studies of human saliva. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 1.

13. Mack, M. H.; Wolf, S., and Stern, K. G. Preliminary electrophoretic analysis of human gastric juice. J. Clin. Invest. 32:862 Sept. 1953.

14. Kinersly, T. Preliminary paper electrophoretic study of saliva. Yale J. Biol. & Med. 26:211 Dec. 1953.

15. Geller, J. H., and Rovelstad, G. H. Spectrophotometry of human saliva. Abstracts, American Chemical Society meeting, Atlantic City, N. J., Sept. 1956, p. 64C

16. Reid, J., and Pigman, W. The organic compounds and enzymes of human saliva. J.A.D.A. 45:325 Sept. 1952.

17. Johnson, V. M.; Chauncey, H. H., and Lisanti, V. F. Investigation of whole saliva protease and proteolytic proenzyme activity. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 39.

18. Police, P. and Donvito, D. Determination of lipase in human saliva. Chem. Abst. 49:14867 Nov. 10, 1955.

19. Leone, V. Salivary lipase. Chem. Abst. 49:14983 Nov. 10, 1955.

20. Hofman, B. A receptor-destroying enzyme in human saliva and its possible relation to poliomyelitis infection. J. Immunol. 73:273 Nov. 1954.

21. Carter, W. J., and others. Oral phosphatase levels and caries activity. Science 123:325 Feb. 24, 1956.

22. Burstone, M. S. Esterase of the salivary glands. J. Histochem. & Cytochem. 4:130 March 1956.

23. Hoerman, K. C.; Englander, H. R., and Shklair, I. L. Lysozyme: its characteristics in human parotid and submaxillo-lingual saliva. Proc. Soc. Exper. Biol. & Med. 92:875 Aug.-Sept. 1956.

24. Nickerson, J. F., and Kraus, F. W. Origin of salivary peroxidases. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 2.

25. Chauncey, H. H., and others. Enzymes of human saliva. I. Determination, distribution, and origin of whole saliva enzymes. J. D. Res. 33:321 June 1954.

26. Giddon, D. B., and Lisanti, V. F. Enzymic change in parotid saliva as related to psychopathology. (Abst.) J. Am. Col. Den. 23:190 June 1956.

one fifth of the amylase, which has a similar but not identical composition to that of swine pancreatic amylase.

Further studies of a physiologically active protein in parotid saliva, the so-called "parotin," have been made.[29] Electrophoretic analyses indicated that the purity was over 70 per cent. The protein had an isoelectric point of 3.4. On its hydrolysis,[16] amino acids were identified. The material may be a hormone and, among other actions, causes a decrease in serum calcium level and promotes the calcification of dentin.

Fibrinolytic activity was demonstrated in human parotid secretion and whole saliva.[30] Small and variable amounts of a plasminogen activator and a large amount of a plasminogen proactivator were found. The system is different from that in blood but resembles that in milk, urine and seminal fluid.

Additional investigations of the nature of the free amino acids and vitamins in whole salivas have been reported. The existence of 18 free amino acids was demonstrated in ultrafiltered whole saliva in microgram amounts.[31] These may be derived by hydrolysis of salivary proteins.[32] Analyses of vitamin A, vitamin C, pantothenic acid, nicotinic acid and biotin were reported for whole salivas.[33] The difference in the concentration of nicotinic acid in the supernatant and in the precipitate from whole saliva emphasizes the difficulty common to salivary studies of the necessity of considering the sediment in analyses and of determining its origin.

In relation to the significance of oral clearance studies and of the stimulatory effect on oral bacteria, the nature and concentration of the carbohydrates present in salivas is very important. The "reducing power" of salivas sampled after foods have been cleared, and of the individual secretions, apparently arises from the presence of many diverse substances, and the concentration of free glucose is less than the sensitivity of the methods, usually about 1 mg. per hundred cubic centimeters.[34, 35, 10] As shown earlier, the glucose concentration in the saliva seems to be independent of that in the blood.[16] Some evidence has been obtained that the "carbohydrate" concentration of whole salivas is related to the diet, and is higher for persons on high carbohydrate diets. The anthrone method is of value for the determination of total "carbohydrate" in salivas.[36, 37]

The nature of the phosphate esters in whole saliva has been further studied by paper chromatography. Easily and difficultly hydrolyzable types were found, and some free adenosine triphosphate seemed to be present.[38]

27. Muus, J. The amino acid composition of human salivary amylase. J. Am. Chem. Soc. 76:5163 Oct. 20, 1954.

28. Muus, J.; Brockett, F. P., and Connelly, C. C. The effect of various ions on the stability of crystalline salivary amylase in solution. Arch. Biochem & Biophys. 65:268, 1956.

29. Ito, Y., and Okabe, S. On the occurrence of a parotin-like substance (saliva-parotin) in the human saliva; studies on the salivary gland hormones. XXVII. Endocrinol. Japonica 2:195 Sept. 1955.

30. Albrechtsen, O. K., and Thaysen, J. H. Fibrinolytic activity in human saliva. Acta physiol. scand. 35:138 Dec. 1955.

31. Woldring, M. G. Free amino acids of human saliva; a chromatographic investigation. J. D. Res. 34:248 April 1955.

32. Lightfoot, L., and Coolidge, T. B. Origin of salivary amino acids. Preprinted abstracts, International Association for Dental Research, thirty-fourth general meeting, St. Louis, March 1956, p. 1.

33. Dreizen, S., and others. Distribution of selected vitamins in human whole saliva. Internat. Zschr. Vitaminforsch. 26:257, 1955.

34. Lundqvist, C. Oral sugar clearance. Its influence on dental caries activity. Odont. Revy 3: Suppl. 1, 1952.

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NUTRITION AND THE MOUTH

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Research in 1956 on nutritional relationships to the oral cavity has resulted in a large number of publications in several widely separated scientific disciplines. Hence, selection of the high lights becomes necessary in place of a comprehensive review.

The studies by Paynter and Grainger[1] on the relation of nutrition to the morphology and size of rat molar teeth represent a landmark in dental investigations. Vitamin A deficiency was imposed on female rats prior to mating and was continued through pregnancy and lactation. The offspring were killed at 20 days of age and detailed measurements made of the maxillary right first molar. Vitamin A deficiency during pregnancy and lactation resulted in the development of molars in the offspring that were appreciably smaller than those of offspring born to normal controls. This decrease in molar size was proportional to the decreased body weight of the animals deficient in vitamin A.

In another experimental group of female rats, supplements of fluoride at 12 ppm during pregnancy and lactation resulted in as large reductions in tooth size among the offspring without commensurate reductions in body weight. A high phosphate-normal calcium diet during pregnancy and lactation also caused a comparable reduction in molar size without any reduction in body weight of the offspring. When the latter diet was begun ten weeks before conception and maintained until weaning, the maximum reduction in molar size was produced with a body weight reduction among the offspring comparable to that in the vitamin A deficient offspring. In addition, the depth of the mesial fissure of the first maxillary molar was less and the angulation of the sides of this fissure was greater than was observed in either of the other experimental or control groups. It would be interesting to know if the density of the enamel and dentin of the smaller molars from the experimental animals differed from that of enamel and dentin from the control animals.

Trace element distribution studies in the various areas of enamel continue to stimulate interest. Much higher fluoride contents in surface enamel have been reported than in subsurface layers.[2] This difference was noted in unerupted and erupted teeth, and in deciduous and permanent teeth. With longer exposure to the oral cavity, there was a gradual but steady increase in the fluoride content of the surface enamel from 571 ppm for the enamel from 20 year old individuals up to 1,247 ppm for the enamel from individuals over 50 years of age. A similar distribution of lead in enamel from unerupted and erupted human teeth was observed, with much higher concentrations in the outer layer than in the deeper layers.[3] Lead levels in the various enamel layers from teeth of older people were higher than in comparable layers from teeth of younger individuals. Tin distribution was unlike lead and fluoride.[4] In unerupted teeth, tin content was comparable in all enamel layers. The tin content in filled teeth was much higher than in unerupted teeth, with the surface layers appreciably higher in tin than the deeper

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layers. In intact teeth, there were slightly higher levels on the outer surface and the over-all levels were higher than for unerupted teeth.

Nutritional relationships to tooth decay continue to receive considerable attention. Developmental studies in hamsters have been reported in which an increased caries susceptibility was observed in the offspring of females fed only the ash of whole wheat for the mineral source.[5] When this diet during pregnancy and lactation was supplemented with 1 per cent calcium hydroxide, the teeth of the offspring had a much higher resistance to tooth decay. The natural diet that resulted in the offspring with the highest resistance to tooth decay contained both whole milk powder and the ash of Purina Laboratory Chow to supply the necessary mineral nutrients. During the posteruptive period in rats, a progressive decrease in the caries score was noted as the calcium-phosphorus ratio of diets with a constant calcium level was decreased from 1:0.5 to 1:2 by variations in the phosphate content.[6] Further decrease to 1:3 had no effect on the incidence or extent of caries. When the phosphorus content of the diet was kept constant and the calcium-phosphorus ratio increased from 0.5:1 to as high as 3.3:1, there was also a 50 per cent decrease in the caries score.[7] The addition of 4 per cent of the Osborne-Mendel salt mixture to a smooth surface caries-producing diet caused a major reduction in the average incidence of smooth surface lesions.[8] Butterfat, Crisco, fluoride, iodoacetate and penicillin also caused reductions in the incidence of smooth surface lesions. Carious lesions were produced on the incisor teeth of rats with particular frequency when the fat soluble vitamins were omitted from the diet and when a 5 per cent dextrose solution was given instead of distilled water.[9] A supplement of 2.5 per cent lysine resulted in a noticeable reduction in smooth surface lesions in rats while 0.1 per cent of dehydroacetic acid was ineffective.[10] Studies designed to adapt a caries-susceptible strain of rats developed in America to laboratory conditions in England resulted in an unforeseen increase in caries-resistance that required extension of the usual experimental period of a maximum of four months to a minimum of six months.[11]

Clinical surveys in communities east of the Cascade Mountains of Oregon revealed dental caries experience among the native born and reared white children 14 to 16 years of age that were strikingly lower than for comparable children in communities west of the same mountain range.[12] Two significant relationships were noted: an inverse relationship between available sunshine and dental caries prevalence with much higher amounts of sunshine in the eastern communities, and a direct relationship between urinary selenium excretion and susceptibility to caries with lower selenium excretion in the eastern communities. Fluoride determinations on the teeth of citizens of India revealed levels of fluoride in the enamel and dentin commensurate

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12. Hadjimarkos, D. M. Geographic variations of dental caries in Oregon. VII. Caries prevalence among children in the Blue Mountains region. J. Pediat. 48:195 Feb. 1956.

with the ingestion of as much fluoride as would be consumed in this country from water supplies containing 2.5 to 3.5 ppm fluoride.[13] Since these subjects lived in areas where the water supplies contain 0.2 ppm or less of fluoride, there must have been a major source in the food to provide this amount of fluoride.

Newer knowledge of the physiologic role of saliva increasingly emphasizes the importance of saliva in the body's economy. Sialoadenectomized rats and mice have been shown to grow at reduced rates.[14] Originally endocrine disorders were suspect; evidence is becoming available suggesting that this reduced growth may be dependent on an error in nutrient metabolism. Sialoadenectomized adult mice were observed to incorporate calcium[45] into bone and several soft tissues more readily than normal mice, which evidence suggests calcium depletion in the operated animals.[15] Balance studies indicated that the sialoadenectomized mice were in a less favorable state of positive calcium balance than were intact animals. Strontium[89] exchange in femurs of sialoadenectomized animals was 175 per cent of the value observed among intact mice.

Sodium concentrations in the saliva of patients with essential hypertension were significantly lower than in normal subjects of the same age.[16] Potassium levels were comparable for both groups. Chloride levels in the saliva were not influenced by sodium chloride ingestion immediately prior to the collection of saliva samples.[17] This finding is in contrast to iodine excretion which increases spectacularly after the ingestion of sodium or potassium iodide. Chloride levels in the saliva from caries-free children were appreciably lower than for children with rapidly progressing caries.

The relation of nutrition to periodontal disease remains challenging, but essentially uninvestigated. Two new species of animals for periodontal disease research have been proposed, however—the white tailed rat of South Africa and the swamp rice rat from the Southern states[18, 19] in North America. Both species can be maintained readily in the laboratory. Protein deficiency in relation to periodontal disease in the hamster has been studied with the suggestion that higher amounts of periodontal disease were observed in the deficient animals.[20] Prolonged tryptophan deficiency in rats resulted in progressive osteoporosis of the spongiosa of the alveolar bone, until by the sixteenth week the alveolar bone had been fragmentized into small islands that appeared as isolated osteogenic centers.[21]

13. Shaw, J. H.; Gupta, O. P., and Meyer, M. E. High fluoride content of teeth from communities with low fluoride water supplies. Am. J. Clin. Nutr. 4:246 May-June 1956.

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Roentgen-ray radiation and the dental patient

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The recent report by the National Academy of Sciences, *The Biological Effects of Atomic Radiation,* has served to focus the attention of many people on the dangers connected with the increasing amount of ionizing radiation that currently is being used for so many purposes. The human race has always been exposed to ionizing radiation of low intensity from natural sources, so the nature of the hazard that confronts the population now is not new; only its magnitude is new. In an effort to keep to a minimum the amount of ionizing radiation that a person receives from all artificial sources of radiation, the current technics and procedures used in dental roentgenography should be reviewed to see if the same result could be obtained with less radiation.[1]

This paper deals with the effect of roentgen-ray radiation on the skin and genes of the patient, the amount of radiation required to produce these effects as compared with the amount of radiation administered to these tissues during oral roentgenographic examination, and methods for reducing the amount of roentgen-ray radiation used for oral diagnostic purposes.

EFFECT OF RADIATION ON THE SKIN

Radiation causes injurious ionization to occur within living tissues. The ionization of even a single atom of the complex protein molecules which make up protoplasm may disrupt the entire molecule. If severe damage is done by a sufficiently high dose of radiation, then whole tissues may be destroyed.[2] Fortunately, the doses of radiation used in dental roentgenography are relatively small. The effect of doses below those which permanently damage the tissues may be modified by processes of healing, so that the response to a dose of radiation which is spread over a long time may be much smaller than, or quite different from, the response which would occur if the same dose were given in a short time. This does not apply to the important type of genetic effect called "gene mutation," which is produced by the irradiation of reproductive cells, the consequences of which are totally cumulative and irreversible.[3]

Excessive exposure of the skin to roentgen-ray radiation manifests itself as an erythema, a first degree burn resembling sunburn. The smallest amount of radiation that will cause a faint reddening of the human skin is the threshold-erythema dose. Qualifications, such as time of appearance of the erythema after exposure, or a statement of a percentage of patients that react to this amount of

Presented before the American Academy of Oral Roentgenology, Atlantic City, N. J., September 29, 1956.

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2. Young, H. H., and Kunkel, M. G. Diagnosis, treatment and prognosis of roentgen ray injuries to dentists. J.A.D.A. 51:1 July 1955.

3. Medical Research Council. The hazards to man of nuclear and allied radiations. London, Her Majesty's Stationery Office, June 1956.

radiation are sometimes included in the definition of the threshold-erythema dose. The dose of radiation required to produce the threshold erythema varies with the quality of the roentgen rays employed. More radiation is required to produce a threshold erythema at higher kilovoltages than at lower.

Belisario[4] investigated the dose of roentgen-ray radiation that will produce the threshold erythema of the skin and found that approximately an additional 50 r are necessary to produce the threshold erythema for each additional millimeter of aluminum that is used to filter the primary roentgen-ray beam.

When operating a dental x-ray machine at 65 kilovolt peak and using a target-skin distance of seven and one half inches, Richards[5] found from testing 29 men of college age that 165 r (measured in air) or 600 milliampere-seconds would produce a threshold erythema on the flexor surface of the forearm on three of each four subjects. The area of skin tested measured one and one-eighth inches in diameter. In this study, the only filtration used was the inherent filtration of the machine, which was equivalent to 1 mm. of aluminum. The half-value layer of the radiation was 0.7 mm. of aluminum. The erythema appeared in two to eight hours after the skin was exposed and remained visible until the third to fifth day, at which time tanning or pigmentation of the skin replaced the erythema. The phase of pigmentation was of 4 to 18 weeks in duration. Loss of hair did not develop at any time within the irradiated areas. The smallest exposure found to produce an erythema was 117 r (measured in air). Recognizing that the skin of the face is less sensitive to roentgen-ray radiation than the skin on the flexor surface of the forearm and utilizing this difference in sensitivity as a safety factor, Richards recommended, under the conditions of these experiments, that no single area of the face be exposed to more than 110 r (measured in air) in any two week period. This was the equivalent to 400 milliampere-seconds of exposure for the equipment and conditions used in this study.

In a study of the effect of radiation on human skin, MacComb and Quimby[6] made 60 tests and found that 185 r (measured in air) would produce threshold erythema of the skin on the flexor surface of the forearm. The 10 by 10 cm. areas of the skin that were tested were irradiated at a distance of 25 cm. with roentgen rays generated at 100 kilovolt peak and filtered by 1 mm. of aluminum.

MacComb and Quimby[6, 7] also investigated the rate of recovery of human skin from the effects of irradiation by roentgen rays. In this study, 32 tests were made using the same technical factors as listed in the previous paragraph. They found that 150 r (measured in air) administered to the same skin area on each of two successive days would produce the same reaction on the skin as would a single dose of 185 r (measured in air). This result implies a skin recovery rate of 77 per cent in the first 24 hours.

An additional 257 tests were made with roentgen rays generated at 200 kilovolt peak. In this latter series of tests on the rate of recovery of skin from the effects of roentgen-ray irradiation, the effect on the skin of the threshold-erythema dose was compared with the same effect produced by two smaller but equal doses of radiation that were administered at varying intervals up to a maximum of four days apart. The results of these experiments indicate that recovery sets in promptly, and at a rapid rate, half of the

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7. Quimby, E. H., and MacComb, W. S. Further studies on rate of recovery of human skin from effects of roentgen- or gamma-ray irradiation. Radiol. 29:305 Sept. 1937.

effect being lost in the first 12 hours. The rate of recovery continually decreases, however, so that during the third and fourth days there is only 6 per cent more recovery than during the first two days. Slightly more than 80 per cent recovery had been achieved by the end of the fourth day.

This research by MacComb and Quimby illustrates the cumulative effect of repeated exposures of the skin to roentgen-ray radiation. Because of some healing that is taking place, there is a daily reduction in the radiation effect that was produced in the skin by the initial exposure, but the remaining radiation effect adds to the effect produced by the next irradiation of the skin. It is evident that some recovery takes place in the skin, but there is no constant rate of recovery from irradiation. Skin recovers from a first irradiation much more rapidly than from any subsequent one.

Based in part on Quimby's work on recovery rates of skin from the effects of radiation and on their own experience and calculations, Poppel, Sorrentino and Jacobson[8] recommended the following:

> Any part of the body exposed to 100 r in air should not be re-exposed for three weeks. Doses of between 60 and 100 r in air may be repeated after two weeks' rest, and doses between 30 and 60 r in air may be repeated after one week's rest. Doses below 30 r in air may be repeated daily provided the total dose per week does not exceed 100 r in air.

On 40 adult patients, Budowsky and his co-workers[9] measured, with ionization chambers, the quantity of radiation received by the skin at eight locations on the face while a 14-film roentgenographic examination was made of the patient. On the average, they found that the exposure of the skin ranged between 55 and 77 r. Some of this measured radiation was filtered first by passing through the face of the patient before it reached the ionization chamber; therefore, a large fraction of the less penetrating rays which were directed from the far side of the face never reached the skin on the near side. A standard dental x-ray machine was used in this study and was operated at 65 kilovolt peak and 10 milliamperes. A short, pointed cone and an added filter of 0.5 mm. aluminum were employed.

Since, according to Budowsky, a 14-film roentgenographic examination can expose certain areas of skin on the face to 77 r, the findings of Poppel indicate that, if the need should arise, the entire examination could be repeated safely after a two weeks' rest.

When the primary beam of the x-ray machine reaches the patient and passes through him, secondary rays are produced by the interaction of the primary beam with the atoms which comprise the patient's oral structures. The secondary rays scatter in all directions and most are of longer wavelength than the primary rays. Both of these properties of scattered radiation contribute to the exposure of the patient. Therefore, scattered radiation should be held to a minimum.

In dental roentgenography the reduction of scattered radiation can be accomplished in two ways. First, it is recognized that an increase in the kilovoltage increases the amount of secondary or scattered radiation produced. Therefore, the kilovoltage chosen should be just sufficient to penetrate adequately the teeth and jaws and no higher. In the second place, the amount of secondary or scattered radiation increases as the volume of irradiated tissue increases.

First, the problem of the proper kilovoltage for adequate penetration will be considered. Through indirect measurements of the radiopacity of the mandible, Richards[10] found that the age of the patient, his facial type (lean, average or

8. Poppel, H. M.; Sorrentino, J., and Jacobson, H. G. Personal diary of radiation dosage. J.A.M.A. 147:630 Oct. 13, 1951.

9. Budowski, Jack, and others. Radiation exposure to the head and abdomen during oral roentgenography. J.A.D.A. 52:555 May 1956.

10. Richards, A. G. Measuring the radiopacity of the lip and mandible. J. D. Res. 32:193 April 1953.

obese), and the thickness of the mandible were factors which could be correlated with the radiopacity of the bone of the lower jaw. Large boned individuals of the lean facial type were encountered that could not be penetrated adequately by roentgen rays generated at 70 kilovolt peak, which indicates that higher voltages are necessary sometimes to secure sufficient penetration of the teeth and jaws for diagnostic purposes. Increased exposure cannot compensate for an inadequacy in penetration. For other types of individuals, voltages as low as 55 kilovolt peak were found to be adequate.

By using aluminum and ivory step-wedges, Wuehrmann and his coworkers[11-13] studied the relation between the optimum potential of the roentgen-ray tube and the diagnostic value of dental roentgenograms. To demonstrate soft tissue and at the same time produce good differentiation between structures of greater densities, they found that it was necessary to use an optimum kilovoltage for intraoral roentgenography of 90 to 95 kilovolt peak, which is in excess of the maximum potential of the tube found in dental roentgen-ray equipment.

Fitzgerald,[14] in his study of the kilovoltage utilized in dental roentgenography, reported that the dentinoenamel junction was shown better at higher kilovoltages, whereas the differences in density of the images cast by the roots and alveolar bone were shown less.

In light of these various studies it appears that when it is necessary to increase the potential of the tube to secure adequate penetration of the oral tissues, a lower contrast roentgenogram will result, but the roentgenogram will demonstrate soft tissue and distinguish between the various hard tissues at the same time.

In addition to an increase in scattered radiation, an increase in kilovoltage steps up both the dose rate and penetrating power of the primary roentgen-ray beam. These two factors permit exposures to be reduced materially. Although scattered radiation reaches the patient's skin at a slightly increased rate at higher voltages, the reduction in the length of the exposure, which is brought about by the higher potential of the tube, results in a desirable reduction in the total amount of radiation that reaches the skin.

Next, it appears pertinent to discuss the reduction of scattered radiation by minimizing the volume of tissue that will lie in the path of the primary beam. The volume of irradiated tissue can be decreased by reducing the diameter of the primary beam. This reduction can be accomplished by the use of cones or diaphragms which are placed in the path of the primary beam.[15] For periapical roentgenography, a reduction in the size of the primary beam to a field 2½ inches in diameter at the tip of the cone will reduce the amount of radiation that normally would scatter back to the skin from underlying tissues and thus avoid an additional exposure of the patient's skin. This reduction in the diameter of the beam also will reduce the amount of primary radiation reaching the skin because it will minimize the overlapping of adjacent exposed areas of skin.

When a roentgen-ray beam is directed at the patient, only the radiation that passes through him and reaches the film can be considered to be useful. Most of the long wavelengths in the primary beam penetrate the patient very superficially before they are absorbed. They contribute to the patient's dose but not to the formation of the image. By suitable filtration, some of these nonuseful rays can be re-

11. Wuehrmann, Arthur H., and Manley, Richard S. Relation between x-ray tube potential and diagnostic value of dental x-ray film. J. D. Res. 29:699 Oct. 1950.

12. Wuehrmann, A. H., and Monacelli, C. J. Selection of optimum kilovoltage for dental radiography; preliminary studies. Radiol. 57:240 Aug. 1951.

13. Wuehrmann, A. H., and Curby, W. A. Radiopacity of oral structures as a basis for selecting optimum kilovoltage for intraoral roentgenograms. J. D. Res. 31:27 Feb. 1952.

14. Fitzgerald, G. M. Dental roentgenography. IV. The voltage factor (kv.p.). J.A.D.A. 41:19 July 1950.

15. Selman, Joseph. Fundamentals of x-ray and radium physics. Springfield, Charles C Thomas, 1954.

moved from the primary beam before they reach the patient.

It would be desirable to develop a filter that would be selective in its action, so that it would stop all nonuseful rays and transmit all of the more penetrating, short wavelength rays with undiminished intensity. Unfortunately, any device used to filter out most of the undesired radiation also removes some of the useful radiation. Therefore, exposures will always be longer when a filter is placed in the primary beam than when no filter is used. Even though the time for exposure must be increased to compensate for the absorption of radiation in the filter, the skin dose of the patient is greatly decreased when a filter is used.

Trout and his coworkers[16] investigated the manner by which various amounts of filtration affected roentgenographic contrast and reduced the patient's dose. They concluded that the highest voltage and thickest filter consistent with adequate contrast for diagnosis always should be used to reduce the patient's dose.

Seemann and Cleare[17] conducted a study designed to answer the question: "Just how much reduction in dosage can be provided for the dental patient by filtering the roentgen-ray beam without detrimentally affecting the roentgenographic image?" They found that additional filtration of from 1 to 1.5 mm. of aluminum could be added to a dental x-ray machine without seriously affecting the contrast in the roentgenogram. This amount of filter was tested on eight x-ray machines and ". . . the average skin dose received by the patient with added filtration was about 57 per cent of the dose that would have been received had not the additional filtration been used." It should be emphasized that the reduction in dosage to the patient was obtained even though the average exposure time was increased by 43 per cent to make up for the absorption of radiation in the filter. As a result of their investigation, Seemann and Cleare concluded

. . . that, under the usual conditions of dental radiography, the diagnostic value of the radiograph cannot be improved by filtering but that in the interest of lessened radiation dosage to the patient, an effective amount of filtration can be introduced without appreciably affecting the value of the radiograph.

At the University of Michigan, on an average, three times as many films are used per patient as were used 20 years ago. Fortunately, during this same period, manufacturers have greatly increased the exposure speeds of films, thereby reducing the amount of radiation to which a patient is subjected by dental roentgenography. The short exposures that are made possible by the use of faster films result in a decrease in dosage not only to the skin of the face but to all parts of the patient.

The change from a technic which employs an 8-inch target-skin distance to one using a 16-inch distance requires that the primary beam pass through an additional 8-inch layer of air. To determine the amount of absorption that this layer of air offers, intensity measurements of the primary beam were made in air at distances of 8 inches and 16 inches from the target. These measurements were made on two x-ray machines with a Victoreen roentgen meter and a 25 r ionization chamber. The inverse square law was applied to the intensity values measured at the 8-inch distance to determine the theoretical value for the intensity of the primary beam at 16 inches from the target.

A Ritter Dual-X machine was tested with 1 mm. aluminum of added filtration and again with no added or external filters at both 50 and 70 kilovolt peak. The same experiments were repeated with a G.E.-90 x-ray machine operating at 50, 70 and 90 kilovolt peak. The

16. Trout, E. D.; Kelley, J. P., and Cathey, G. A. Use of filters to control radiation exposure to patient. Am. J. Roentgenol. 67:946 June 1952.

17. Seemann, H. E., and Cleare, H. M. Reduction of x-radiation dosage by filtration. D. Radiog. & Photog. 28:61 No. 4, 1955.

pointed plastic cones were in place during these tests. At each voltage, the calculated and measured values of the intensity of the radiation at a distance of 16 inches from the target were the same within the limits of the experimental error which develops in making these measurements.

This same problem can be approached through theoretical considerations.

The minimum wavelength of the radiation generated in any roentgen-ray tube is determined by the following equation:

$$\lambda_{\text{min.}} = \frac{12.4}{\text{kv.p.}}$$

At 70 kv.p., the minimum wavelength, λ min., is equal to

$$\lambda_{\text{min.}} = \frac{12.4}{70} = 0.177 \text{ A.}$$

The effective wavelength of the heterogeneous radiation which comprises the primary beam is about 2.25 times the minimum wavelength.

$\lambda_{\text{eff.}} = 2.25\ \lambda_{\text{min.}} = 2.25\ (0.177) = 0.40$ A.

By using the "exponential law of absorption," the amount of absorption offered by an 8-inch layer of air can be calculated.

$I = I_o e - (\mu/p) p x$

I is the intensity of the transmitted radiation.

I_o is the intensity of the incident radiation

μ/p is the mass absorption coefficient of the absorber

p is the density of the absorber

x is the thickness of the absorber

For $\lambda_{\text{eff.}} = 0.40$ A, $(\mu/p)_{\text{air}} = 0.3561$.

$p_{\text{air}} = 0.0012$ gms./cc.

$x = 8 \times 2.54 = 20.32$ cm.

$I = I_o e^{-(0.3561)\ (0.0012)\ (20.32)}$

$= I_o e^{-0.0087}$

$= 0.991\ I_o$

From the calculations, it will be found that at 70 kilovolt peak, 99.1 per cent of the incident radiation is transmitted through eight inches of air and only 0.9 per cent of the radiation is absorbed. Of course, most of this absorption occurs among the rays of longer wavelength, but the total amount is small, so the filtering action of this layer of air is small. The percentage of absorption by air becomes even less at higher voltages. The absorption of the primary beam by eight inches of air being less than 1 per cent explains the difficulty in detecting this amount of absorption by ordinary experimental means. These experimental measurements and theoretical considerations indicate that the extra eight inches of air, through which the primary beam must pass when comparing 8-inch and 16-inch target-skin distances, do not absorb much radiation or appreciably filter the beam to afford greater protection to the patient.

With the trend continuing toward shorter exposures, manufacturers of x-ray machines are beginning to provide more reliable timers for the accurate timing of the small fractional second exposures that have been made possible with higher voltage and higher film speeds. It is hoped that in the future all dental x-ray machines will be equipped with these improved timers.

DAMAGING EFFECT OF RADIATION ON GENES

Radiation affects all living tissues. Some tissues are relatively resistant to radiation, whereas others are extremely sensitive. Genetic damage appears to result from much smaller doses of radiation than those required to produce any other radiation effect in the body. To understand what effect radiations have on genetic processes, some basic information about genetics itself must be reviewed.[2, 18-20]

18. National Research Council. The biological effects of atomic radiation. Washington, National Academy of Sciences, 1956.

19. Stone, R. S. Concept of maximum permissible exposure. Radiol. 58:639 May 1952.

20. Muller, H. J. Radiation damage to the genetic material. Am. Scientist 38:33, 126 Jan. 1950.

Every cell of the body contains a large number of diverse hereditary units called "genes." These genes are too small to be seen by a microscope, yet they are capable of self-reproduction and normally are passed down unchanged from one generation to another. Of all the genes which an individual possesses when the original egg is fertilized, half are inherited from each parent. As the cells of the body divide, the genes are duplicated faithfully in each new cell. Genes, however, can be changed or altered by certain agents, notably by heat, certain chemicals, and ionizing radiations. These changed genes or mutations then are passed down in their new form to successive generations.

Mutations of genes can occur in somatic cells as well as in germ cells. If the mutant gene is in a somatic cell, then it merely is passed along to other body cells and is not passed on to progeny. In this instance the effect of the mutation is limited to the person in whom the mutation occurred. Likewise, the genetic consequences of the irradiation of individuals beyond the age of reproduction are of course nil.

Mutations are constantly occurring at a "spontaneous mutation rate." Available evidence suggests that between 2 and 20 per cent of these naturally occurring mutations may well be induced by exposure to the background radiation that results from natural causes such as cosmic rays and the naturally radioactive minerals of one's environment. In the United States, each person receives between 4 and 5 r from unavoidable exposure to background radiation in a 30 year period. Exposure to any additional radiation, however slight, causes an increase in the rate of mutation. There is no evidence and little likelihood that this additional radiation causes new types of mutations to occur, only more of them. A rise in the rate of mutation is probably directly proportional to the amount of additional exposure to radiation.

Damage to genes is cumulative and irreparable. Long continued exposure to radiation of low intensity induces as much gene mutation as a single exposure to an equal dosage of radiation of higher intensity.

There is little knowledge of the genetic effects of ionizing radiation on man that is based on direct evidence.

Three direct studies have been made on the children of human beings who have been exposed to ionizing radiations. Two, on the children of American radiologists, were for a variety of reasons inconclusive; the third is an extensive study made by the Atomic Bomb Casualty Commission on the children of those who were in Hiroshima and Nagasaki when the atomic bombs exploded. All three studies are limited to observations on the first generation, so that little genetic effect would yet have become manifest even if the mutation rate had increased.[a]

Much of the knowledge of genetics has come from numerous experimental studies made with plants and the fruit fly, *Drosophila*. Some studies also have been made with mice. From such studies has come valuable information regarding the amount of ionizing radiation that must be administered experimentally to double the "spontaneous rate of mutation" occurring in these organisms. The question arises, however, to what extent is it justifiable to draw inferences concerning man from the reactions of these remote organisms observed under the artificial conditions of laboratory experiment? Stone[19] has answered this important question in the following manner:

W. L. Russell, at Oak Ridge National Laboratory, giving single acute doses to mice, reports that the mutation rate per roentgen is considerably higher in the mouse than in *Drosophila*. Russell concludes: "From a cautious scientific point of view, it would be unwise to generalize from this, but from the point of view of those concerned with the immediate problems of protection in man, it would be risky to ignore the fact that the data indicate that estimates of human hazards based on *Drosophila* mutation rates may be too low."

Experiments performed with these lesser organisms indicate that over 99 per

cent of all radiation-induced mutations which have effects large enough to be detected are harmful in some way. It has been said:

> On the average, a detrimental mutation, no matter how small its harmful effect, will in the long run tip the scales against some descendant who carries this mutation, causing his premature death or his failure to produce the normal number of offspring.[20]

Geneticists generally are agreed that it requires an exposure of the human gonads of between 30 and 80 r to double the "spontaneous rate of mutation." It has been said further:

> At present something like 2 per cent of all U. S. children are born with some noticeable genetic defect. If we were subjected generation after generation to an additional 30 to 80 roentgens, this figure would gradually rise to 4 per cent.[16]

In an effort to keep this tragic percentage of noticeable genetic defects from rising much higher, the National Academy of Sciences has recommended "The average exposure of the population's reproductive cells to radiation above the natural background should be limited to 10 roentgens from conception to age 30."[16] At the present time about one third of this suggested limit of 10 roentgens is being spent, mostly on medical, and to a far lesser extent, on dental roentgen rays.

Stanford and Vance[21] conducted a study to determine the quantity of radiation received by the reproductive organs of patients during various routine diagnostic roentgen-ray examinations. It must be emphasized that the doses quoted in their study are those produced by the technics and methods of only one British hospital, and that this hospital is one where particular care is taken to reduce the gonad doses to the minimum. The dental x-ray machine used in this study was operated at 65 kilovolt peak, 10 milliamperes and at a target-film distance of 8 inches. The half-value layer for the radiation generated by this machine was 1.0 mm. aluminum. They reported that when an average exposure time of 1 second per film was used in the 14-film periapical examination, the male gonads received a dose of 0.34 milliroentgens per film and the female gonads received a dose of only 0.06 milliroentgens.

It is believed that intermediate-speed dental films are in widest acceptance in the United States, so the average exposure time would be 3 seconds as opposed to the 1 second exposures used in the British hospital study. If a 3 second exposure is assumed, the dose to the gonads per 14 exposures would be approximately 0.0143 r and 0.0025 r for males and females, respectively. If 20 complete mouth periapical examinations of 14 exposures each were made of individuals during the first 30 years of their lives, the male gonads would receive about 0.3 r and the female gonads 0.05 r. These are very small amounts of additional radiation that reach the gonads when compared to the unavoidable exposure of between 4 r and 5 r that each person receives from background radiation in a 30 year period. Even so, in an effort to keep the expenditures of radiation as low as possible, those in dental roentgenography should review current methods and practices to see if the same result could be obtained with less radiation.

PROTECTIVE MEASURES FOR THE PATIENT

The various factors which directly or indirectly control the amount of radiation which the patient receives are:

1. Target-film distance
2. Diameter of primary beam
3. Filtration of primary beam
4. Kilovoltage
5. Film speed

21. Stanford, R. W., and Vance, J. Quantity of radiation received by the reproductive organs of patients during routine diagnostic x-ray examination. Brit. J. Radiol. N. S. 28:266 May 1955.

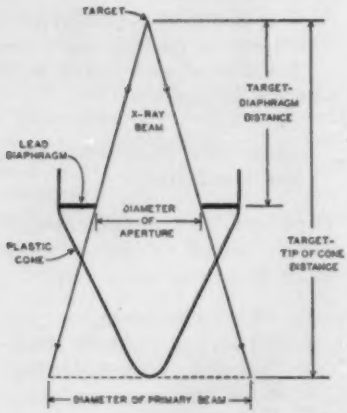
Table 1 • Factors for converting exposures for changes made in target-film distances

Original target-film distance	New target-film distance							
	8 in.	9 in.	10 in.	12 in.	14 in.	16 in.	20 in.	36 in.
8 in.	1.	1.26	1.56	2.25	3.06	4.	6.25	20.25
9 in.	.79	1.	1.23	1.78	2.42	3.16	4.94	16.
10 in.	.64	.81	1.	1.44	1.96	2.56	4.	12.96
12 in.	.44	.56	.69	1.	1.36	1.78	2.77	9.
14 in.	.33	.41	.51	.73	1.	1.31	2.04	6.61
16 in.	.25	.32	.39	.56	.77	1.	1.56	5.06
20 in.	.16	.20	.25	.36	.49	.64	1.	3.24
36 in.	.05	.06	.08	.11	.15	.20	.31	1.

6. Developing time
7. Milliampere-seconds of exposure

These factors will be discussed in turn.

Target-Film Distance • Various target-film distances are employed in dental roentgenographic procedures. When a change from one target-film distance to another is made, the exposure also must be changed to compensate for the change in the intensity of the radiation at the new distance. Table 1 provides the factors for converting exposures for changes made in the target-film distances.



$$\left(\begin{matrix}\text{DIAMETER}\\ \text{OF APERTURE}\end{matrix}\right) = \left(\begin{matrix}\text{DIAMETER OF}\\ \text{PRIMARY BEAM}\end{matrix}\right) \times \frac{\text{TARGET-DIAPHRAGM DISTANCE}}{\text{TARGET-TIP OF CONE DISTANCE}}$$

Determination of correct aperture diameter

Diameter of Primary Roentgen-Ray Beam • Earlier in this paper it was suggested that at the tip of the cone, the diameter of the primary beam be limited to 2½ inches by placing a diaphragm of lead, with a suitable aperture in it, in the path of the beam. Usually such diaphragms are made of 1/16 inch sheet lead and are located in the base of the cone on the machine. Diaphragms of lead can be made at home easily, because sheet lead can be cut easily by a scissors or pocket knife. Suitable lead, designated as "4 pound" sheet lead, can be obtained at plumbing shops. The correct diameter of the aperture in the diaphragm can be determined by reference to the illustration. The distance between the target and the diaphragm must be known for these computations and, since it cannot be measured directly, it is found by measuring the distance from the diaphragm to the tip of the cone and subtracting this quantity from the distance between the target and the tip of the cone. For various dental x-ray machines, the distance between the target and the tip of the cone is listed in Table 2.

Filtration of the Primary Roentgen-Ray Beam • Filtration of the primary beam is accomplished through the use of inherent and added filters. Inherent filtration is

caused by the absorption of the beam by the glass window of the roentgen-ray tube, the oil which surrounds the tube, the portal in the roentgen-ray head through which the rays emerge, and the plastic cone. Added filtration is obtained by placing thin sheets of aluminum in the plastic cone to filter further the primary beam. Total filtration is the sum of the inherent and added filtration.

In Table 2, various dental x-ray machines are listed by name along with the amount of inherent filtration they exhibit.

In Regulation 8 of the sanitary code of the Public Health Council of the State of New York is a recommendation that "Filtration equivalent to at least a total of 2 millimeters of aluminum shall be used with all diagnostic x-ray equipment."

To bring the total filtration of a dental x-ray machine up to the equivalent of 2 mm. of aluminum, the dentist can obtain from the manufacturer of his x-ray machine, or can himself cut out, one or more disks of commercially pure aluminum of suitable thickness to make up the difference between the inherent filtration listed in Table 2 and the recommended total filtration equivalent to 2 mm. aluminum.

Table 2 • Distance between target and tip of cone

Name of x-ray machine	Distance from target to tip of pointed cone	Equivalent inherent filtration
General Electric		
CDX Models E, 70 and 90	8.0 in.	1.5 mm. aluminum
Ritter		
Models B and Dual-X	7.0 in.	1.0 "
Model E (Century)	7.0 in.	2.25 "
Universal	7.25 in.	0.5-0.75 "
Weber		
Raydex	6.25 in.	0.5 "
Westinghouse	6.25 in.	0.7 "
X.R.M.		
Models 2 and 3 before 1956	5.5 in.	0.75 "
Models 2 and 3 since 1956	5.5 in.	2.00 "
Model 90	5.5 in.	2.00 "

Table 3 • Factors for converting exposures for changes made in kilovoltage (direct exposures only)

Original kilovoltage	New kilovoltage						
	60	65	70	75	80	85	90
60	1.	0.77	0.6	0.47	0.37	0.29	0.25
65	1.29	1.	0.77	0.61	0.48	0.37	0.32
70	1.66	1.29	1.	0.79	0.62	0.48	0.42
75	2.1	1.63	1.26	1.	0.79	0.6	0.52
80	2.66	2.06	1.6	1.26	1.	0.76	0.66
85	3.48	2.69	2.	1.65	1.3	1.	0.87
90	4.	3.1	2.4	1.9	1.5	1.15	1.

Prepared by Arthur W. Fuchs.

Commercially pure aluminum is commonly designated as 1100 or as 2S. For some dental x-ray machines, the added filtration may be as great as 1.5 mm. aluminum. When this maximum amount of added filtration is used, it will be necessary to increase the kilovoltage slightly or to increase the usual times for exposure by about 50 per cent. With less added filtration, the exposure need not be increased so much.

Kilovoltage • When it is desirable to change from one kilovoltage to another, the exposure also must be changed to compensate for the change in penetration and dose rate of the roentgen-ray beam. Table 3 provides the factors for converting exposures for changes made in kilovoltage.

Film Speed • When it is desirable to change from a dental film of one speed to another, the exposure also must be changed to compensate for the difference in film speeds. Table 4 provides the factors for converting exposures for changes made in film speeds.

Developing Time • Fast-acting developing solutions are available commercially which will develop a dental film completely in 3½ minutes at 65° F. If the developing time at this temperature is prolonged to five minutes, a 25 per cent reduction in the time of exposure can be

Table 4 • Factors* for converting exposures for changes made in film speed

Name of original film	Name of new film							
	DuPont-S	Kodak Regular	Rinn DC	DuPont-D	Kodak Radia-Tized	Rinn EF	DuPont Lightning Fast	Kodak Ultra-Speed
DuPont-S	1.0	1.0	0.75	0.5	0.5	0.17	0.08	0.08
Kodak Regular	1.0	1.0	0.75	0.5	0.5	0.17	0.08	0.08
Rinn DC	1.33	1.33	1.0	0.67	0.67	0.22	0.11	0.11
DuPont-D	2.0	2.0	1.5	1.0	1.0	0.33	0.17	0.17
Kodak Radia-Tized	2.0	2.0	1.5	1.0	1.0	0.33	0.17	0.17
Rinn EF	6.0	6.0	4.5	3.0	3.0	1.0	0.5	0.5
DuPont Lightning Fast	12.0	12.0	9.0	6.0	6.0	2.0	1.0	1.0
Kodak Ultra-Speed	12.0	12.0	9.0	6.0	6.0	2.0	1.0	1.0

*Factors relate to films available January 1957.

realized.[22] The factors for converting exposures for changes made in developing time for fast-acting developers are contained in Table 5.

Milliampere-seconds of Exposure • A definite quantity of roentgen-ray energy must be absorbed by a given roentgenographic emulsion to produce a latent image which subsequently can be developed into a visible image of diagnostic value. The first four technical factors which have been discussed previously control the quality and the intensity of the radiation which reaches the emulsion, whereas the milliampere-seconds of exposure control its quantity. It matters little which combination of milliamperes and seconds is employed to produce an exposure of a given number of milliampere-seconds provided that the product of the milliamperes and seconds remains constant. When movement of the patient is a problem, it is advantageous to use a large current and a short exposure-time to expose the roentgenographic emulsion. Sometimes longer exposures with less current may be more desirable.

Example • The use of the data contained in the various tables can be illustrated by means of an example.

Suppose that the following factors were used at a given region with the following dental roentgen-ray technic:

9 inch target-film distance
65 kilovolt peak
10 milliamperes
Rinn DC film
3½ minutes developing at 65° F. in fast-acting developer
Exposure: 10 milliamperes x 2 seconds = 20 milliampere-seconds

Suppose further, that for technical reasons, as well as the desire to reduce the patient's dose to a minimum, an alteration in technic is desirable so as to use the following factors:

16 inch target-film distance
85 kilovolt peak
Kodak Ultra-Speed film
Five minutes developing at 65° F. in fast-acting developer

What would the correct exposure be under these new conditions?

	Exposure conversion factors
Changing from 9 inches to 16 inches (Table 1)	3.16
Changing from 65 to 85 kilovolt peak (Table 3)	0.37
Changing from Rinn DC to Kodak Ultra-Speed film (Table 4)	0.11
Changing from 3½ to 5 minutes developing (Table 5)	0.75

These four conversion factors are multiplied together to obtain an over-all

22. Richards, A. G. Roentgenographic technics made to order. J.A.D.A. 39:396 Oct. 1949.

exposure conversion factor of 0.1. To reduce further the radiation dosage to the patient the dentist with a designated x-ray machine may want to use an additional filter of 1.5 mm. of aluminum. The use of such a filter may require that the exposure be increased by 50 per cent, so the factor for converting exposures now becomes 1.5 times 0.1, or 0.15.

When this added filter and the new technic are used, the exposure of the given region, originally 20 milliampere-seconds, now becomes 0.15 times 20 or 3.0 milliampere-seconds. When shortness of exposure time is of greatest importance, the necessary 3.0 milliampere-seconds of exposure could be obtained by exposing for 0.2 seconds at 15 milliamperes. For x-ray machines with timers that do not control accurately fractional seconds of exposure, the necessary 3.0 milliampere-seconds of exposure could be obtained by exposing for 1 second at 3.0 milliamperes.

The use of these various exposure conversion factors may result in roentgenograms that do not meet the dentist's standards of correct film density; therefore, the calculated exposures may have to be increased or decreased slightly until such standards are realized.

CONCLUSIONS

Budowsky found that a 14-film roentgenographic examination could expose certain areas of the skin on the face to 77 r. Richards' studies indicate that, to avoid production of an erythema of the skin, no single area of the face should be exposed to more than 110 r (measured in air) in any two week period. From these two studies it appears that there is little likelihood that an erythema of the face would result from a 14-film roentgenographic examination.

Table 5 • Factors for converting exposures for changes made in developing time for fast acting developers

Developing time at 65° F.	Exposure conversion factors
3.5 min.	1.
5.0 min.	0.75

The results of the study made by Stanford and Vance, when translated into exposure times that are used in the United States, indicate that the roentgen-ray dose to the gonads for 20 complete mouth roentgenographic examinations of 14 films each would be 0.3 r and 0.05 r for males and females, respectively. These are extremely small amounts of additional radiation to the gonads in comparison with the unavoidable exposure of between 4 and 5 r that each person receives from background radiation in a 30 year period.

The amounts of radiation that reach the skin and gonads could be reduced appreciably by various changes in technic.

The Passage of Time • Great spaces of time passed in unbroken uniformity tend to shrink together in a way to make the heart stop beating for fear; when one day is like all the others, then they are like one; complete uniformity makes the longest life short. *Thomas Mann, The Magic Mountain.*

Roentgenographic observations of functioning temporomandibular joints

William J. Updegrave, D.D.S., Philadelphia

Within the past quarter century, dentistry has experienced a forward impetus which, to a large extent, is the result of a more widespread use of the roentgenographic unit. Characteristic of this progress has been the discarding of old accepted dictums, the reversal of long-established concepts, the questioning of "positive" clinical diagnoses and the development of new and sometimes revolutionary treatment programs. Roentgenography of the temporomandibular joints, however, is still being used too infrequently. Not until its value is recognized in functional analysis of the joint and in diagnosis of its syndrome will roentgenography receive the recognition and acceptance that it deserves.

The value of temporomandibular joint roentgenography varies in the opinion of different investigators, but the majority acknowledge the assistance that good roentgenographic evidence contributes. One investigator[1] states: "The use of lateral jaw roentgenography is very helpful in verifying and sometimes in making a diagnosis. Findings in these roentgenograms are sometimes surprising and frequently very useful." Another worker[2] writes,

> For a long time I felt that roentgenograms of the temporomandibular joint were of little diagnostic value. However, as the clinical evaluation of this problem developed, the roentgenograms became of increasing value until today I feel they are invaluable and a necessary aid in diagnosing temporomandibular joint complaints.

Since it is generally agreed that roentgenographic evidence is an essential part of the diagnostic procedure, should there not be more interest evidenced in temporomandibular joint roentgenography by the general practitioner of dentistry? With this in mind, the writer[3] presented a simplified technic for roentgenography of the joint which, by using a few easily constructed accessories, could be performed without special training. The hope was that this would stimulate dentists to augment their knowledge and to improve their analyses and treatment of temporomandibular joint problems. The present paper, describing some applications of temporomandibular joint roentgenography, is similarly motivated.

The practice of making static roentgenographic studies of the bony and dental structures of the masticatory system

Professor of radiodontics, Temple University School of Dentistry.

1. Block, L. S. Diagnosis and treatment of disturbances of the temporomandibular joint especially in relation to vertical dimension. J.A.D.A. 34:253 Feb. 1947.
2. Vaughan, H. C. Temporomandibular joint pain. A new diagnostic approach. J.Pros.Den. 4:694 Sept. 1954.
3. Updegrave, W. J. Radiographic technique for the temporomandibular articulation. Am.J.Orthodont. 39:495 July 1953.

has long been a satisfactory procedure. Static roentgenograms of the temporomandibular joints with their variable functional range, however, are limited in their information. Donovan[4] writes:

> A functional analysis utilizing various terminal reference positions, rather than a static analysis of joint structure, provides greater accuracy and a wider range of usefulness for temporomandibular joint roentgenograms.

To minimize the value of static studies of the joint, however, would be an error. Erosion of condyles and eminences, calcific deposits on condyles, fractures, neoplasms, developmental defects, ankylosis and the effects of rheumatoid arthritis are but some of the conditions in which the static roentgenograms are essential to complete diagnosis.[5]

One of the methods of studying function of the temporomandibular joints is cinefluorography—a motion picture of fluorescent images of the joints. The equipment required for this type of examination is costly and its narrow applicability means that its use is limited to research centers, teaching institutions and hospitals.

In lieu of this the serial method of making multiple roentgenographic exposures is recommended. This technic makes it possible to record the various condylar positions on the same film by maintaining the head of the patient in a fixed position, utilizing the slide tunnel principle and moving the cassette for as many as six exposures on one film.[3] The change in condylar-fossa relationship can be followed with each change in mandibular function. This technic has some advantages over cinefluorography in that the examination can be performed more readily, the films are examined more easily, tracings from the roentgenograms can be made and compared, minor changes in function are discerned more readily, measurement of components in their natural relationship is possible, and the parts are portrayed in their normal size.

APPLICATIONS OF SERIAL ROENTGENOGRAPHY

Condylar Function in Patients with Class I, Class II, and Class III Occlusal Relations • Masticatory movements vary among individuals and depend largely on the size and shape of the jaws and on the shape, position and relation of the teeth. A functional roentgenographic study of temporomandibular joints representing three types of jaw relationships was done by selecting three patients with full complements of teeth; one with a Class I relationship (patient A); the second with a Class II, Division 2 relationship (patient B), and the third with a Class III relationship (patient C). Serial roentgenograms of the temporomandibular joints of each were taken with the mandible in the following six consecutive positions: (1) occlusion; (2) rest; (3) ¼ inch opened (incisal region); (4) ½ inch opened; (5) 1 inch opened, and (6) maximal opening (Fig. 1). The maximal opened position for the Class I and Class III patients measured 1¾ inches in the incisal region, and for the Class II patient 1½ inches. The roentgenograms were then traced and the following observations made:

Patient A (Class I) (Fig. 1A, 2)—Opening from occlusion to rest, the condyle rotated; from rest to the one inch opening, the condyle rotated and moved downward and forward to a position directly below the articular eminence; and from one inch to maximal opening, translatory movement predominated as the condyle moved forward to a position slightly anterior to the eminence.

Patient B (Class II) (Fig. 1-B, 2)—In opening from occlusion to rest the condyle moved downward and forward, and,

4. Donovan, R. W. Method of temporomandibular joint roentgenography for serial or multiple records. J.A.D.A. 49:401 Oct. 1954.

5. Updegrave, W. J. Evaluation of temporomandibular joint roentgenography. J.A.D.A. 46:408 April 1953.

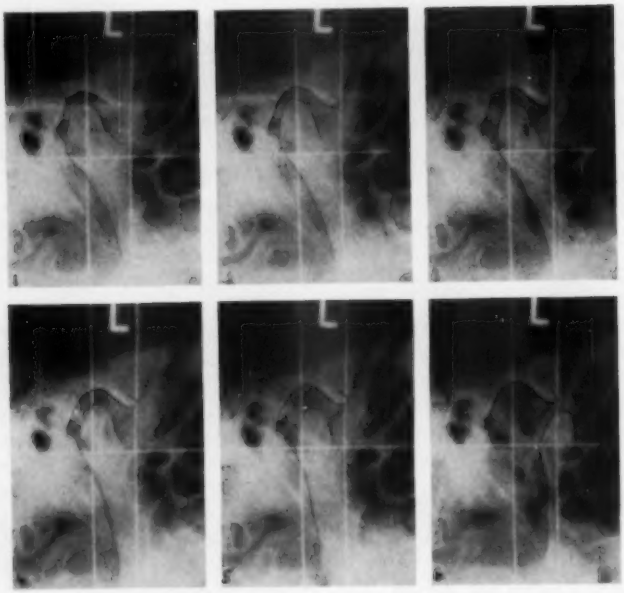


Fig. 1 • A: Serial roentgenograms of left temporomandibular joint of Patient A (Class I type)

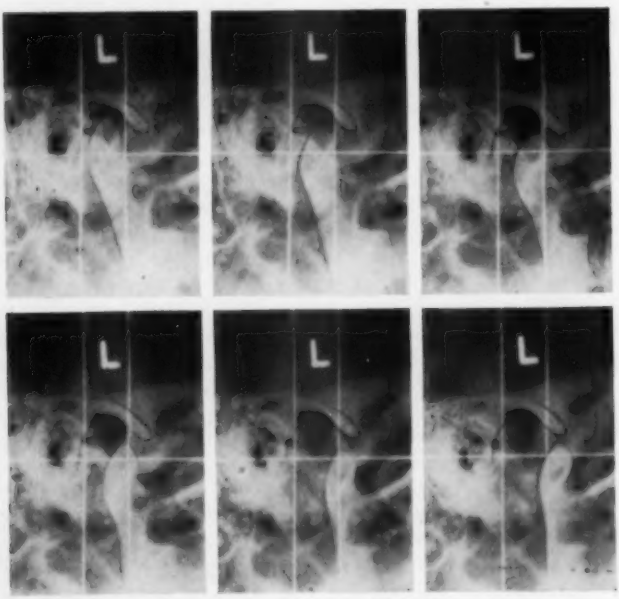


Fig. 1 • B: Serial roentgenograms of left temporomandibular joint of Patient B (Class II Division 2 type)

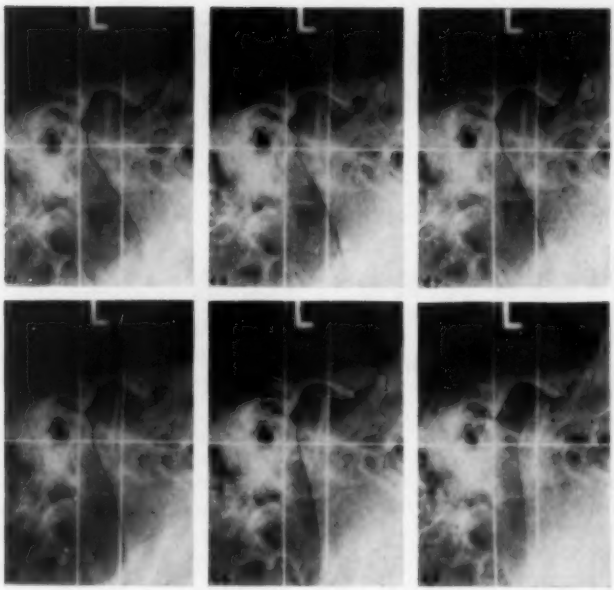


Fig. 1 • C: Serial roentgenograms of left temporomandibular joint of Patient C (Class III type)

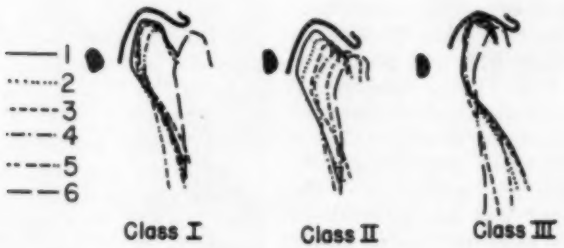


Fig. 2 • Condylar tracings from roentgenograms in Figure 1. Occlusal (1) to maximal opening (6)

with translatory movement predominating, continued in this downward and forward path to the one-inch opened position where the condyle was below the articular eminence. Thence, the condyle moved forward to a point slightly anterior to the eminence when the mandible was in a position of maximal opening.

Patient C (Class III) (Fig. 1-C, 2)—From occlusion to the one-inch opened position, the condyle primarily rotated with little noticeable translatory movement. From this point to one of maximal opening, translatory movement predominated and the condyle moved downward and forward to a position slightly distal

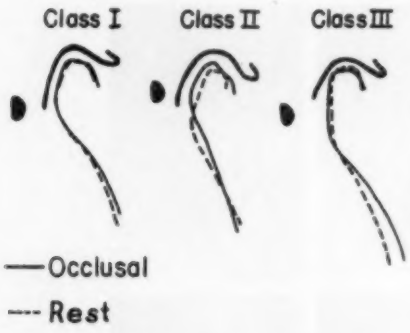


Fig. 3 • Condylar tracings from roentgenograms in Figure 1. Occlusal and rest positions

to the eminence. The condyle remained well within the confines of the fossa during the entire functional cycle.

Two extremes of functional activity are demonstrated in the Class II and Class III patients, translatory function predominating in the former while rotatory function predominated in the latter. A more nearly balanced combination of both functions is seen in the Class I type.

A further observation can be made on condylar function from rest position to closure. The Class II type does not exhibit the conventional rotatory movement from rest to occlusion as do the Class I and Class III types (Fig. 3). Rather, there is a translatory movement of the condyle upward and backward to its normal position when the teeth are closed. This behavior pattern is similar to that observed by Ricketts.[6] He found 68 per cent of 50 Class II patients registered condylar movements upward and backward from 2 to 7 mm. when closing their jaws from rest to occlusion.

It should be understood that the aforementioned observations are typical and based on ones made of temporomandibular joint roentgenograms over a period of seven years. Even though pronounced variations have been seen that would seem to refute these observations, the findings indicate the trend in the majority of normal joints examined.

Range of Condylar Function of 90 Dental Students • In cooperation with R. B. Hedges, a survey was made of 90 junior dental students whose average age was 27 years. Cephalometric roentgenograms were taken with teeth in occlusion, jaws in physiologic rest position, and jaws opened to a 30 mm. incisal opening. It was felt that information of a more practical nature would be gained from the 30 mm. position than from the maximal opened position since 30 mm. is about one and a quarter inches, an average functional opening. Roentgenograms of the temporomandibular joints were also taken with the teeth in occlusion and with jaws opened to a 30 mm. incisal opening. Models were made from alginate impressions, and a questionnaire was circulated seeking occlusal and temporomandibular joint information; these completed the survey.

The range of translatory movement of the condyles from the occlusal position to 30 mm. incisal opening was measured and found to vary from zero to 20 mm. Sixty-one per cent functioned within a range of 7 to 10 mm. (Fig. 4). Condylar hypermobility of 18 to 20 mm. was observed in four individuals, but this occurred in one joint only, the range of the opposite condyles measuring from 5 to 11 mm. This will be discussed later in the paper.

An attempt to correlate joint form with condylar function met with little success. Figure 5 illustrates joints moving from 2 mm. to 16 mm.; it will be noted that there are few anatomic differences except in the joints functioning at 16 mm. In these the fossae are shallower and the slopes of the eminences less steep, but this has not been a uniform observation.

6. Ricketts, R. M. Laminagraphy in the diagnosis of temporomandibular joint disorders. J.A.D.A. 46:620 June 1953.

Rather it appears that muscular function, dictated largely by jaw and tooth relations, is the dominant factor, the joint being secondary.

Uniformity of Function Between Both Condyles of 90 Dental Students • Of the 90 students, measurements showed that 68 (75 per cent) had uniform translatory function of both condyles; 16 (17 per cent) had a 3 to 5 mm. differential in translatory movement between their condyles while 7 (8 per cent) displayed a 5 to 10 mm. differential (Fig. 6).

When one condyle manifests greater translatory movement than the other, abnormal or altered function usually is present. This is the result of a trained neuromuscular action necessitated by some factor or factors which interfere with the naturally perfect balance and rhythmic functioning of the masticatory system. This acquired neuromuscular pattern is most frequently traceable to some malfunctioning occlusal relationship. Any interference in the normal path of closure initiates this protective action by the proprioceptive system which results in mandibular deviation in function to avoid the interference when bringing the teeth into occlusion. Such behavior can also occur in patients whose masticating efficiency is impaired by missing, sensitive or malposed teeth.

When the models of the 23 students having translatory differentials of 3 to 10 mm. between their condyles were examined, the most common observations were steep cuspal anatomy with considerable intercuspation. Deep anterior overbites were also common to this group, with wear patterns discernible on some teeth which indicated cuspal interferences. One-sided chewing habits were observed for seven, four of whom had missing teeth on the nonchewing side. The other three had full complements of teeth with those on the chewing side displaying superior functional surfaces and relations.

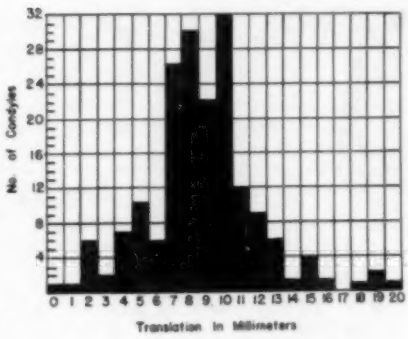


Fig. 4 • Chart depicting translatory range, at 30 mm. incisal opening, of condyles of 90 dental students

Conditions Producing Dissimilar Function Between Condyles • The pattern of mandibular deviation is of clinical significance in patients complaining of temporomandibular joint disturbances. Since the deviation is a clue to acquired or altered function of the condyles, recognition and elimination of the factors responsible for the deviation are essential parts of the treatment program. An example of this is seen in the following.

A 30 year old woman complained of dull pain in the right temporomandibular joint region. This had been present for an indefinite period, "at least two years," but had become progressively more severe since extraction of the right and left mandibular third molars four months prior to her visit. She gave a history of orthodontic treatment and stated that she "always chewed on the right side because it was more comfortable." The pain became more noticeable during and after eating. Roentgenographic examination of the temporomandibular joints revealed no pathosis. At the position of functional opening (30 mm. in the incisal region), the left condyle moved 9 mm. while the right rotated with practically no translatory movement (Fig. 7). Clinical observation showed that the mandible deviated toward the right in opening (Fig. 8).

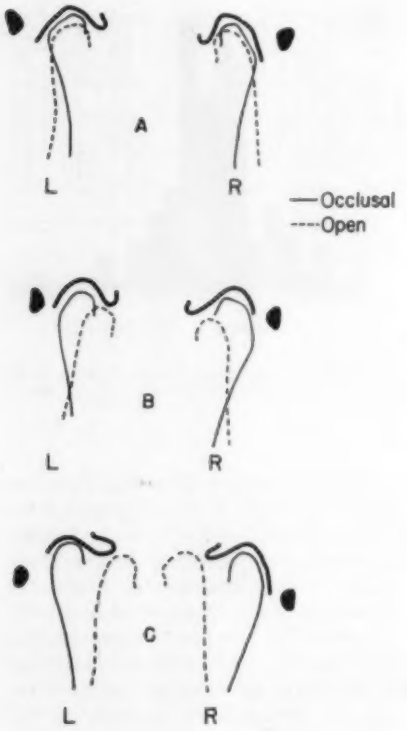


Fig. 5 • Condylar tracings showing variance in translatory range. At 30 mm. incisal opening, condyles A moved 2 mm.; condyles B moved 8 mm.; condyles C moved 16 mm.

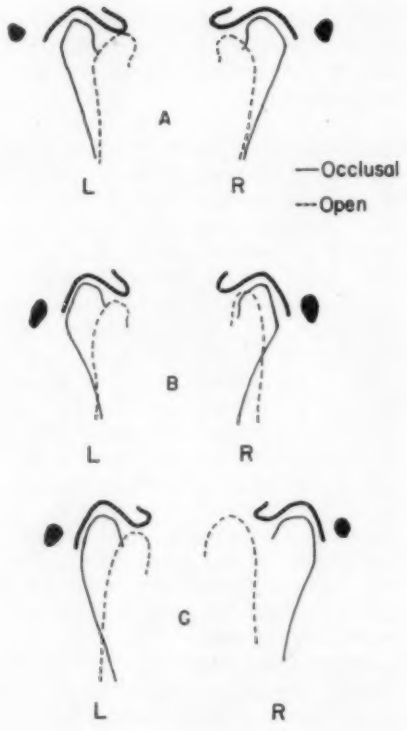


Fig. 6 • Condylar tracings showing dissimilarity in function between right and left condyles. Patient A: uniform function (10 mm.); Patient B: left condyle moves 8 mm., right 4 mm.; Patient C: left condyle moves 10 mm., right 20 mm.

Teeth with steep cuspal planes were observed, and definite evidence of cuspal interference was present when the mandible was directed in a normal path of closure. Apparently the mandibular deviation to the right was a learned behavior pattern developed to avoid the interfering cusps and to follow an unobstructed pathway to closure.

Removal of the cuspal interferences and correction of the occlusal relations to harmonize with the normal muscle function facilitated mastication on both sides and relieved the pain in the right joint almost immediately. The patient was encouraged to masticate on the left side, and within one month she was free of pain for the first time in two years. Two and one-half years after this treatment the temporomandibular joint was functioning normally without recurrence of pain.

The length of time that a patient can continue an abnormal pattern in mastication depends on the degree of abnormality and the tissue adaptability and tolerance of the individual. If the abnormal action can be carried on within physiologic limitation of the tissues, then clinical manifestations of trouble will be

lacking. At the same time, this continued abnormal function may produce tissue damage without exceeding the pain threshold. Then some act occurs, such as yawning, or perhaps opening the mouth to take a large bite, or the patient is subjected to an operation requiring maximal opening over a prolonged period, for example, tonsillectomy, oral surgery or operative dentistry. Any of these may exert a sudden strain on the already overtaxed tissues, thereby precipitating a pain-spasm reaction aggravating the dysfunction and creating definite clinical manifestations.

Proper treatment of patients manifesting these conditions depends on ascertaining the original cause of the dysfunction and correcting it before the condition becomes acute. In the acute stage, it is sometimes difficult to determine the primary etiologic factor, and treatment with analgesics, anesthetics, prosthetic appliances, and so forth—according to the symptoms presented—may be necessary as a preliminary measure. Only by the determination and correction of the original cause, however, can improvement of a permanent nature be achieved.

Mandibular deviation with dissimilarity in condylar function may be seen also in patients with developmental abnormalities. A six year old boy displayed clinical evidence of arrested development of the left condyle (Fig. 9), as well as roentgenographic (Fig. 10 and 11, left). The mandible deviated toward the left in opening (Fig. 9) which was reflected in the condylar behavior as shown in Figure 11, right. Deviation of the mandible to the affected side has been observed to be the usual pattern when these conditions are present. Forceps delivery, several falls in infancy and early childhood—one severe enough to dislodge a maxillary incisor at 21 months—together with generally poor health and malnutrition which required hospitalization when the infant was seven months old, were factors which undoubtedly contributed to the developmental abnormality and subsequent dysfunction.

Brodie[7] writes:

> Anything that is capable of arresting the proliferative activity of the cartilage forming cells, which provide for the addition of new bone at this site (mandibular condyle) will bring about the deformity characteristic of these cases.

There was no pain associated with joint function.

A 32 year old woman with asymmetrical development of the face (Fig. 12, left), demonstrated another condition of atypical functioning of the condyles. The overdevelopment of the right side of the mandible, dating from childhood, resulted in the present occlusal relation (Fig. 12, center) with its impaired function. This patient was extremely conscious of the asymmetry and developed the habit of holding her mandible to the left in a more esthetic relationship. She also opened to the left (Fig. 12, right, 13 and 14). Complaints of lack of "good chewing surfaces" and crepitus in the right temporomandibular joint were partially met by the correction of several premature occlusal contacts. A dull pain in the right joint region, of which the patient had been conscious for over a year, also was relieved by the occlusal correction. This treatment, however, could never completely solve the problem and, after consultation, it was recommended that the patient embark on a sound program of reconstruction.

Trauma, infection, arthritis, trigeminal neuralgia, sclerosing solution, meniscectomy, condylectomy, fracture, unilateral ankylosis, Parkinson's disease and neoplasms are other conditions that can cause mandibular deviation and must be considered in the diagnosis.

Condylar Function in Minor Occlusal Discrepancies • From a functional view-

7. Brodie, A. G. Contribution of the mandibular condyle to the growth of the face. In The temporomandibular joint. Sarnat, B. G., editor. Springfield, Ill., Charles C Thomas, 1951, pp. 49-64.

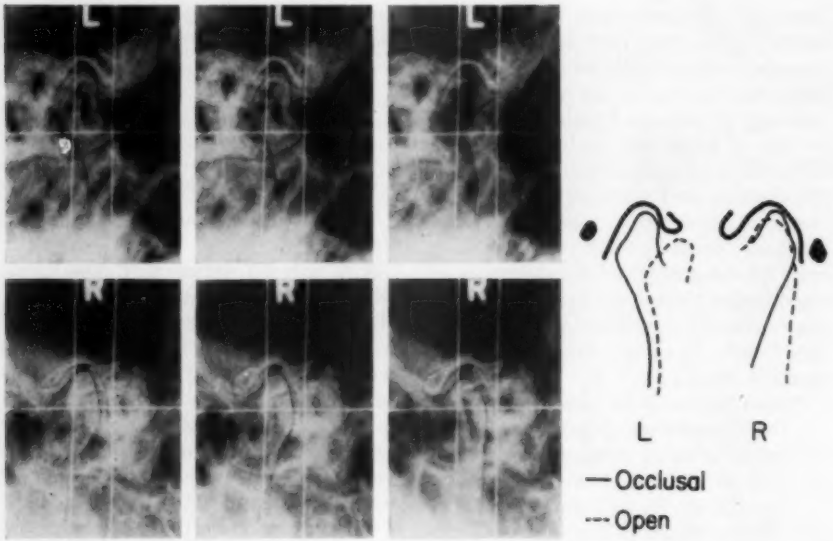


Fig. 7 • Left: Serial roentgenograms of temporomandibular joints. Shows condyle with mandible in occlusion, rest position and open. Right: Joint tracings of condylar function: left condyle moves 9 mm., right condyle rotates with little translatory movement

point, analysis of the path of closure from rest to occlusal position is of utmost importance in determining the etiologic factors in occlusion which result in temporomandibular joint disturbances. Describing this function, Thompson[8] states:

The normal movement of the mandible from rest to occlusal position is almost that of a hinge with the common axis located in the vicinity of the condyles or lower portions of the joints—there may be slight bodily movement of the condyles, but slight movement of the condyles should still be considered to be within the normal range.

8. Thompson, J. R. Concepts regarding function of the stomatognathic system. J.A.D.A. 48:626 June 1954.

Fig. 8 • Mandibular deviation to right when opening. (Note malrelationship between maxillary left lateral incisor and mandibular left cuspid)

Fig. 9 • Arrested development of left condyle with mandibular deviation toward affected side when opening

Fig. 10 • Mandibular deformity characteristic of arrested condylar development

If in the path of closure from rest to occlusal position, the condyles function uniformly on an approximate hinge axis, it is generally accepted that there is coordinated action between the muscles (centric position) and the teeth (centric occlusion).

For normal functioning of the mandible from rest to terminal occlusal position, there must be a free and unobstructed pathway through which the mandible moves, guided by balanced musculature and uniformly functioning temporomandibular joints. If a premature contact or contacts are encountered in this action, the mandible is then directed into an abnormal path of closure, the normal muscle behavior pattern is upset, the temporomandibular joints are no longer in balanced function, and the teeth meet in malocclusion. Stress is exerted, in proportion to the severity of the discrepancies, on each part of the masticatory system. This predisposes the teeth to abrasion or loss of supporting bone, the muscles to spasms, pain and altered function, and the temporomandibular joints to afunctional habits leading to pain and degeneration. The symptoms and severity of injury in each region vary with the condition and depend largely on the tissue adaptability and pain tolerance level of the patient.

Dentists frequently see patients with varying degrees of disharmony between muscle function and tooth relation, but too infrequently are the disharmonies recognized. This is probably because most patients develop functional patterns to

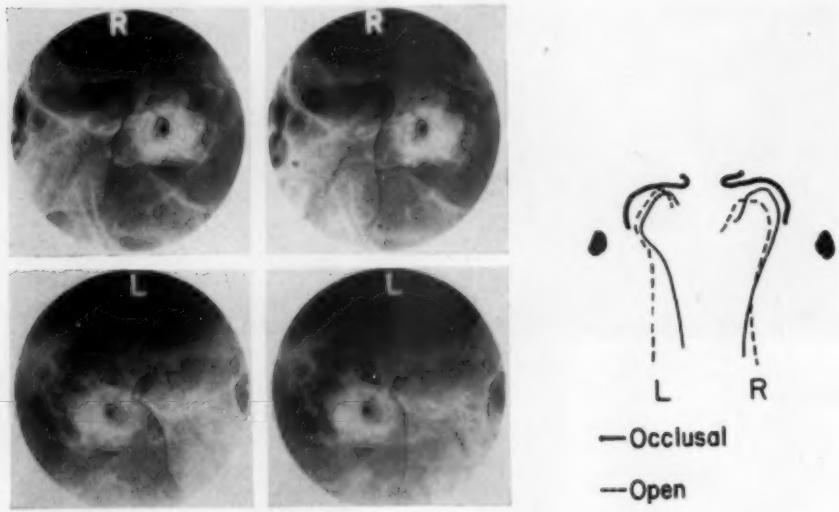


Fig. 11 • Left: Roentgenograms of temporomandibular joints showing normal right condyle and abnormally developed left condyle. Right: Tracings of condylar function. Compare abnormal posterior-superior translatory movement of affected (left) condyle in open position with more normal anterior-inferior translatory movement of right condyle

avoid the interferences and thus move the mandible directly into a position of displacement without too apparent clinical signs. Vague discomfort, which the patient has learned to tolerate, rather than severe pain, which would demand attention, is another reason why the condition is overlooked or ignored.

When dysfunction is established, correction is usually indicated but to begin correction of the occlusion from a static relationship of occlusal position as given by the patient is functionally unsound. This occlusal position may be one of mandibular displacement, and corrections based on it may accentuate rather than relieve the dysfunction by encouraging a continuance of the abnormal relation rather than correcting it.

A functional, rather than a static approach should be the initial step in establishing harmony between muscle function and tooth relations. Detailed descriptions of this functional clinical approach have been given by Brown,[9] Williams,[10] Thompson,[8] Cobin,[11] and others. The procedures followed by each vary somewhat, but they all have the common goal of locating and correcting the factors responsible for disharmony in the masticatory function.

A typical example of functional disharmony was seen in a 33 year old woman who, during a routine examination, casually mentioned some minor trouble on the left side of her head. On further questioning, she stated that she could not remember when she had been free from a headache. Repeated visits to her physician and dentist had resulted in treatment

9. Brown, S. W. Disharmony between centric relation and centric occlusion as a factor in producing improper tooth wear and trauma. D. Digest 52:434 Aug. 1946.

10. Williams, C. H. M. Correction of abnormalities of occlusion. J.A.D.A. 44:748 June 1952.

11. Cobin, H. P. Temporomandibular syndrome and centric relation. New York D.J. 18:393 Oct. 1952.

Fig. 12 • Left: Facial asymmetry. Center: Occlusal relationship. Right: Mandibular opening pattern to left

of a palliative nature, but with no permanent results. She had resigned herself to the idea that nothing could be done and that she had to learn to live with her problem. She stated also that at times the pain in her left frontal and temporal regions was severe and that she frequently felt soreness on the left side of her throat.

Clinical examination revealed a mandibular opening pattern deviating toward the left (affected side), a crepitus in the left temporomandibular joint, and trigger zones in the left masseter and internal pterygoid muscles (Fig. 15). All of these conditions indicated muscle spasm and abnormal function. The functional occlu-

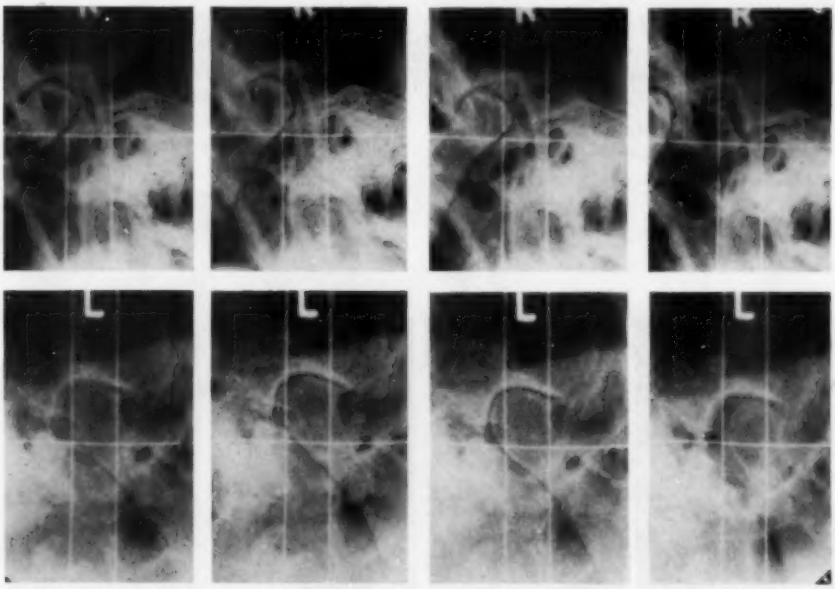


Fig. 13 • Serial roentgenograms of temporomandibular joints. Note rotatory movement predominates in left condylar function, whereas translatory movement predominates in right. Mandible in centric position, rest, in initial contact, 1 inch incisal opening

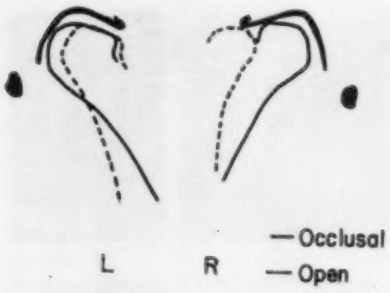


Fig. 14 • Tracings showing condylar function. In opening, left condyle moves 4 mm. whereas right condyle moves 15 mm.

sal analysis revealed premature contacts in the normal path of closure which thereby directed the mandible anteriorly and leftward into a position of displacement with the teeth in occlusion (Fig. 16). Wear patterns were readily discernible on the teeth (Fig. 17), but no periodontal change or loss of supporting bone was evident. Hence, the major stress of the dysfunction was directed to the neuromuscular system and the temporomandibular joints.

The roentgenographic examination revealed normally outlined joints free of pathosis. In functioning, however, both condyles displayed a predominantly rotatory action. From occlusal position to the point of maximum opening, the translatory movement of the right condyle was 5.0 mm. while the left moved only 1.5 mm. (Fig. 18).

After relieving the muscle spasm with ethyl chloride spray and procaine as advocated by Schwartz,[12] the teeth were ground to establish a harmonious adjustment of muscles requisite to occlusal function. Six days later the pain had disappeared from her throat, and she was greatly relieved in the temporal and frontal regions. A second occlusal adjustment was made at this time. One week later she was free from pain with the exception of occasional slight frontal headaches for which she was referred to an ophthalmologist. Crepitus, to a greatly lessened degree, was still present two months later in the left temporomandibular joint; however, the improvement, together with the freedom from all pain, produced a grateful patient.

The pain of muscle spasm induced by the unbalanced function was thought to be abetted by another pain with its source in the articular cartilage of the left joint. The abnormal rotation of the left condyle, induced by deviation of the malfunctioning mandible, conceivably re-

12. Schwartz, L. L. Ethyl chloride treatment of limited, painful mandibular movement. J.A.D.A. 48:497 May 1954.

Fig. 15 • Pain response of affected muscles. Palpation of left masseter and internal pterygoid muscles produced pain in trigger areas. Right side was free of trigger areas

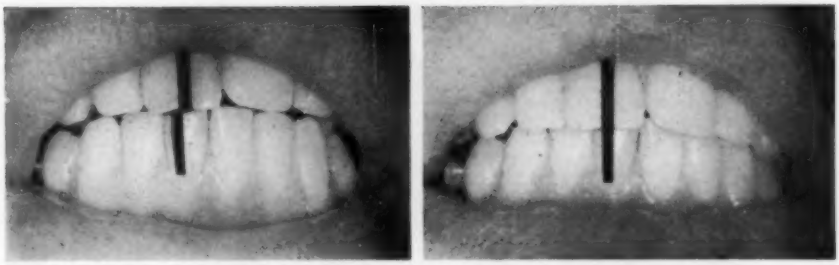


Fig. 16 • Left: Same patient as shown in Figure 15. Relationship of jaws at initial contact. Right: Mandible guided to left in terminal occlusion

sulted in an impingement on the posterolateral region of the articular disk. This portion, being vascular,[13, 14] was thought to be the source of pain from within the joint itself.

Another patient, a woman, aged 30, demonstrated a similar disharmony between muscle function and tooth relationship, but with different clinical manifestations. This patient gave no history of pain in either joint region; the purpose of her visit was for relief of soreness in the maxillary left molar region and for periodontal therapy. Intraoral roentgenograms revealed horizontal bone resorption in both jaws (Fig. 19) with vertical bone resorption in the maxillary left molar region (especially around the first molar), and around the maxillary left lateral incisor, maxillary right second molar,

13. Robinson, M. Temporomandibular joint: theory of reflex controlled nonlever action of the mandible. J.A.D.A. 33:1260 Oct. 1946.

14. Landa, J. S. Integration of structure and function of the temporomandibular joint. New York J.Den. 24:290 Aug.-Sept. 1954.

Fig. 17 • Models showing premature contacts

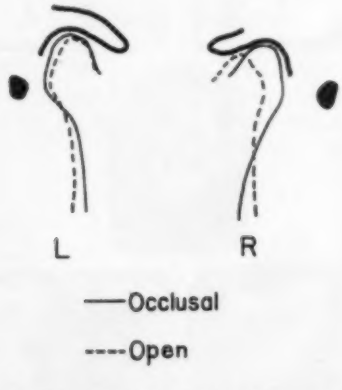


Fig. 18 • Condylar tracings showing unbalanced function with limited translation in maximal opened position. Left condyle moved 1 to 2 mm., right condyle 5 to 6 mm.

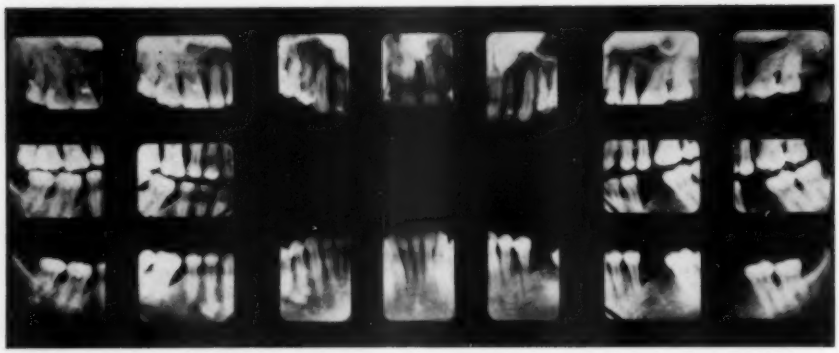


Fig. 19 • Intraoral roentgenograms showing general loss of alveolar supporting bone

mandibular left second and third molars, and the mandibular right second bicuspid (Fig. 20). An anterior mandibular displacement to the right was noted when the occlusal function was analyzed. When the mandible followed a centric path to closure, the first premature contact was the maxillary left first molar which acted as a pivot. From this point (Fig. 22, left), the mandible was directed forward and to the right. It continued in this path as the teeth met in further contact until, at terminal closure, the mandible was displaced to the position seen in Figure 22, right. The teeth which showed the greatest loss of supporting bone were the same teeth that were pri-

Fig. 20 • Specific areas manifesting advanced loss of supporting bone

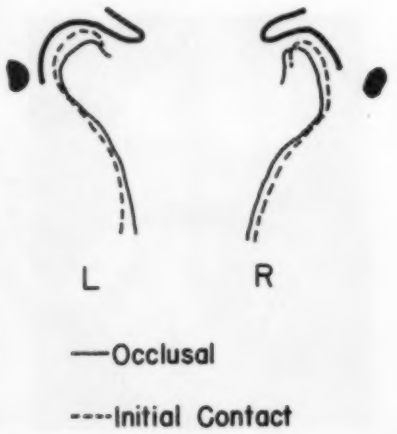


Fig. 21 • Condylar tracings showing anterior displacement with teeth in occlusion

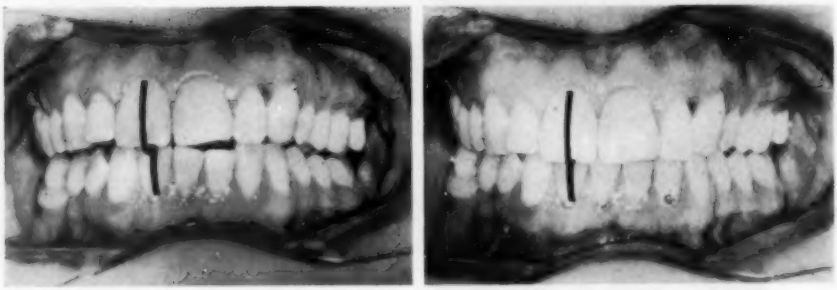


Fig. 22 • Left: Jaw relationship at initial contact. Right: Mandibular displacement to right in terminal occlusion

marily responsible for the mandibular displacement.

That this displacement was a strained position is apparent on the roentgenograms of the temporomandibular joints which show both condyles held in an anteroinferior position when the teeth are in occlusion. When, however, the neuromuscular system was allowed to function freely without tooth interference, the mandible was drawn posteriorly and the condyles assumed a more normal posterosuperior position in the fossae (Fig. 21).

In view of the abnormal function and mandibular displacement, the absence of symptoms in the musculature and the temporomandibular joints indicated a high degree of tissue adaptability and a correspondingly high pain threshold for this patient. The effects of the dysfunction were seen in the supporting alveolar bone.

A third patient, a woman, aged 32, was referred for determination of the etiologic factors responsible for acute pain in the region of the right temporomandibular joint. In her history were two significant facts: a habit of chewing exclusively on the right side, and bruxism which was gradually intensifying, especially during the night. She had first noticed minor discomfort shortly after surgical removal of three mandibular posterior teeth ten months prior to her visit. Intermittent attacks of pain became progressively worse until she was compelled to seek relief. The opening of the mandible was limited to 19 mm. in the incisal region, with deviation to the right in function. A gross premature contact was noted between the mesial lingual cusp of the maxillary left first molar, which was overerupted, and the rest on a clasp of a partial lower denture on the distal lingual surface of the mandibular left second bicuspid (Fig. 23). In closing, the mandible was directed in a normal path to the point of premature contact whence it was guided by the teeth into a position of occlusal displacement slightly anterior and to the right of normal (Fig. 24).

Roentgenograms of the temporomandibular joints showed both condyles functioning in balanced relationship to the position of initial contact. In the final position of closure, however, the left condyle was displaced forward while the right condyle was forced backward (Fig. 25). Occlusal corrections, including the construction of a new replacement and re-establishment of the masticatory mechanism in harmonious balanced function, was advised. The relief was almost immediate, and one year later the mandible was functioning normally and the patient experiencing no pain.

The original or specific cause of this problem may be attributed to occlusal

Fig. 23 • Models showing areas of initial contact

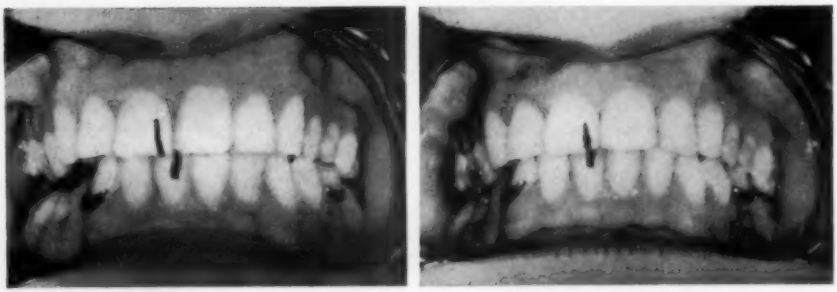
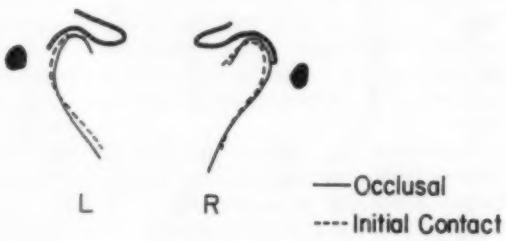


Fig. 24 • Left: Jaw relationship at initial contact. Right: Mandibular displacement to right in terminal occlusion

Fig. 25 • Condylar tracings showing anterior displacement of left condyle and posterior displacement of right condyle from initial contact to terminal occlusion



disharmony which induced the right-sided chewing habit and encouraged bruxism. The latter two contributed to the condition but produced no symptoms since tissue adaptability was not exceeded and the pain experienced was within the tolerance of the patient. The lengthy operation of tooth removal with the mouth forced open maximally most of that time, was the exciting cause which produced the acute symptoms and made her seek treatment.

COMMENT

Jankelson[15] writes, "The evidence strongly suggests that centric occlusion is the only tooth contact of any significance that occurs during stomatognathic function." If this is so, it would seem logical, in the best interests of coordinated function, that this position of centric occlusion first be established beyond any question, as has been repeatedly suggested in this paper. Further corrections, as indicated, then can be made. Clinically, this procedure has proved sound, for in most instances it has resulted in the successful treatment of many acute and chronic temporomandibular joint syndromes. When the malrelationship is extreme, it may be impossible to make the necessary corrections by grinding. In these instances, the use of orthodontic appliances or prosthetic reconstructions may be indicated.

SUMMARY AND CONCLUSION

1. Observations of functioning temporomandibular joints by means of serial roentgenography, will lead to better understanding of the temporomandibular syndrome.

2. Serial roentgenographic studies of condylar functions in Classes I, II, and III types of occlusal relationships were made.

3. Observations were recorded on the range of condylar translation and on the uniformity of condylar function of 90 dental students.

4. Mandibular deviation in function will produce an unbalanced condylar action that can be observed on the roentgenograms. An understanding of how and why this affects the functional harmony of the stomatognathic system will greatly aid in treatment planning.

5. Since Jankelson's[15] investigations indicate that centric occlusion is the only tooth contact of any significance that occurs during stomatognathic function, this position should be established positively and then corrections made to and from it.

6. The pertinent facts essential to an understanding of the roentgenographic observations made in six patients are included.

15. Jankelson, Bernard; Hoffman, G. M., and Hendron, J. A. Physiology of the stomatognathic system. J.A.D.A. 46:375 April 1953.

Humility of the Scientist • I do not know what I may appear to the world, but to myself I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me. ***Sir Isaac Newton.***

Oral cancer—clinical implications of recent research

Reidar F. Sognnaes, D.M.D., Ph.D., Boston

The subject of this symposium—"Oral Cancer-Clinical Implications of Recent Research"—is an important part of a growing problem of health and welfare in the United States, the study and care of the aged, gerontology and geriatrics. Of those Americans who today are 65 years of age, the average man is expected to live until he is 78, the average woman until 80. It is estimated, furthermore, that within the next 25 years the United States may have about 30 million people over 65 years of age. It is obvious, therefore, that the problems of the aged—early recognition and prevention of various chronic and degenerative diseases, and improved means of determining the true biological age of the aging and old—will become more and more important. In this broader context, the clinical manifestations of various atrophic, hypertrophic, degenerative and neoplastic changes in the tissues of the oral cavity, and the basic mechanisms of epithelial cornification and desquamation of the oral mucosa, take on increased significance.

It was with reference to this problem that Thomas Parran, former Surgeon General of the United States and present dean of the Graduate School of Public Health, University of Pittsburgh, recently made a strong plea for further research on the soft tissues of the mouth, a field, he stated, which is awaiting attack on a broader base and with greater vigor. Speaking specifically of the problem of geriatrics, he said:[1]

> . . . it has been suggested that the changes which occur in the oral mucous membrane might be used as one of the sensitive tests of physiological aging. Better yardsticks are badly needed to measure physiological age, especially in relation to the ability to work. Many of us who have studied the current criteria for retirement recognize that chronological age is not in itself an adequate measure of the physical and mental capacity of the individual. Physiologists are seeking to develop simple and more accurate criteria which would have practical application to industry. I feel that our dental colleagues may be able to make a real contribution to this issue by basic research and a new appraisal of the status of the oral mucous membranes and periodontal tissues.

In keeping with this view it seems very appropriate that attention be directed to research on oral cancer, a problem of increasing significance to the dentist and his aging patients. Oral cancer accounts for about 70 per cent of the cancers of the upper alimentary and respiratory tracts. Of all human cancers, 4 per cent occur in the mouth. The dental profession has a unique opportunity to recognize oral cancer in its early and curable stage—before the patient may have become aware of the disease—and hence has an opportunity to contribute both to prevention and to research, and to the health, education and welfare of all citizens.

Presented as an introduction to the symposium, "Oral Cancer—Clinical Implications of Recent Research," before the Section on Research, ninety-seventh annual session, American Dental Association, Atlantic City, N. J., October 1, 1956.

Professor of oral pathology and associate dean, Harvard School of Dental Medicine.

1. Parran, Thomas. Pioneering for health. J.A.D.A. 51:332 Sept. 1955.

PRECANCEROUS LESIONS

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When a sufficient number of oral carcinomas arise at the site of an existing nonmalignant lesion, it is assumed that this lesion has the potentiality of developing cancer, and is frequently spoken of as a precancerous lesion. The most common precancerous lesion in the oral cavity is called leukoplakia. Probably the first complete description of this disease can be accredited to Butlin in 1885.[1] Since that time numerous investigators have contributed to the literature, and all seem to be in agreement that leukoplakia has a potentiality for the development of carcinoma. Impressions vary, depending on the interests of the investigator. An attempt will be made to record some personal observations made of patients visiting a dental clinic, an oral surgery clinic in a hospital, and a head and neck section of a tumor clinic.

In the examination of 275 patients having oral carcinoma, 60 per cent had carcinoma at the site of leukoplakia. Twenty-two patients with leukoplakia diagnosed by microscopic examination and without evidence of cancer were closely observed for four years. At the end of the time, eight of these patients had developed carcinoma at the site of leukoplakia.

Etiologically, the most common irritant associated with leukoplakia was tobacco. The highest incidence of leukoplakia was found in the pipe smoker, and the lowest incidence in cigarette smokers, with cigar smokers and tobacco chewers in between. The association with the use of tobacco may be conjectural. In several instances cessation of smoking resulted in regression of the leukoplakia, depending on the duration of the lesion and its state of development.

The highest incidence of leukoplakia was in men. Three elderly women having leukoplakia had smoked pipes since early childhood and they had the same distribution of the lesions commonly seen in the male pipe smoker. The highest incidence of all leukoplakia was in persons in the fourth to sixth decades of life. Three men patients between the ages of 26 and 30 who were pipe smokers had diffuse leukoplakia involving the buccal mucosa, tongue, and floor of mouth.

These observations suggest that the process of aging is an important factor, and that variations in the response of the oral mucosa to smoking may be associated with a physiological aging process, as compared with chronological age. This also suggests the host factor is a determinant in the response of oral mucosa to irritants.

Further evidence for this belief is seen in the individual who has smoked a pipe for years without evidence of leukoplakia. This observation is rare, but such individuals exist.

Syphilis and oral leukoplakia co-exist and again the causal relationship is not clear. In 14 patients having leukoplakia and in whom there was serological evidence of syphilis, the incidence of carcinoma developing at sites of leukoplakia was 100 per cent. In addition to the high incidence of carcinoma, there is a tendency for new carcinoma to form at locations which preclude the possibility of recurrence of the original malignancy.

A group of individuals with leukoplakia has been observed and reported on previously.[2] This group consisted of

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Professor of dental medicine, Harvard School of Dental Medicine.

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2. Nathanson, I., and Weisberger, D. Treatment of leukoplakia buccalis and related lesions with estrogenic hormones. New England J.Med. 221:556 Oct. 12, 1939.

approximately 65 women between the ages of 45 and 60. In all of these patients, spontaneous menopause had been present for some time. There was no use of tobacco recorded in any instance. When these patients were treated with estrogens, many patients showed regression of the leukoplakia. In this group achlorhydria was present in 43 per cent of the patients. A macrocytosis without anemia was a frequent observation. Excluding the finding of syphilis and menopause, no other clinical observation could be discovered which was common to groups of patients in whom oral leukoplakia had been demonstrated.

Further observations were made on leukoplakia, the structural change of which has been well documented. Histochemical studies were made on excised leukoplakia. A decrease in the glycogen content was noted. The amount varied from a considerable decrease to complete absence of glycogen. This finding was later confirmed by precise chemical analysis.

Studies were extended to include analysis of tissue adjacent to the leukoplakia but which appeared normal on gross and microscopic examination. In this apparently normal tissue, chemical analysis also showed this tissue to have a diminished glycogen content. Recent studies suggest an abnormal metabolism of glucose by these tissues. Further details of these observations on human tissue will be reported in the near future.

The final group of patients exhibiting precancerous lesions are those in whom a diagnosis of Plummer Vinson syndrome was established. This syndrome was first described by Plummer in 1914. It is characterized by atrophy of oral mucosa, dysphagia, changes in the finger nails, and iron deficiency anemia. Eighteen women patients with this syndrome have been under observation for a period of from 4 to 8 years. All of these women had carcinoma, either at the first visit or developed it while under observation. Two of the patients removed their full dentures after the treatment of the original carcinoma. In these two patients after eight years no new carcinomas have developed. This is unusual, because most of these patients show a tendency to develop new carcinoma. One patient so far has had seven new carcinomas. The treatment of the anemia has had no effect on the eventual development of carcinoma. Metabolic studies of excised mucosa from these patients suggest abnormal patterns of oxidative mechanisms in this tissue before carcinoma develops. In other atrophies of the oral mucosa, the incidence of carcinoma is no different than would be found in the general population.

In summarizing these observations, no single factor can account for the development of a precancerous lesion. The response of the tissue to the irritant appears to depend on the host factor within the tissue cells. When a precancerous lesion is associated with a generalized disease pattern, the incidence of carcinoma is greatly increased.

PREDISPOSING FACTORS IN ORAL CANCER

Seymour J. Kreshover, D.D.S., M.D., Ph.D., Bethesda, Md., and John J. Salley,† D.D.S., Ph.D., Richmond, Va.*

Extreme difficulty may be met in establishing a well defined line of demarcation between so-called predisposing factors and exciting causes in oral carcinoma. Obviously, there is much overlapping between these categories of pathogenesis, particularly with regard to those factors that continue to be in the realm of hypothesis and conjecture.

As indicated by clinical studies, a variety of predisposing factors may be of significance in the development of lesions otherwise attributed to more direct influences such as irritation from jagged teeth, ill-fitting dentures or prolonged use of tobacco.[1, 2] Although this may suggest that the cited sources of chronic irritation are exciting factors acting on a tissue already possessing an inherent tendency to cancer, it is entirely possible that they, in themselves, may predispose the mucosa to malignant change.

That a deficiency in vitamin A can cause epithelial metaplasia has been demonstrated many times.[3, 4] It is not surprising, therefore, that clinical evidence points to the possible role of avitaminosis A in the etiology of both leukoplakia and cancer.[5] Swift, in 43 instances of vulval leukoplakia, attributed the lesions to deficient absorption of vitamin A associated with achlorhydria.[6] This contention was substantiated by the beneficial results which followed administration of dilute hydrochloric acid and vitamin A. Somewhat similar clinical evidence was presented by Orr[7] in the case of oral cancer. Orr was interested in the prevalence in India of this malignant condition and its possible relation to betel nut chewing; he concluded from studies in different geographic areas, that the incidence is related directly to states of nutrition, especially of vitamin A.

Also implicated as a predisposing factor in leukoplakia and cancer is vitamin B deficiency. In this connection, other factors such as chronic alcoholism become significant as they might influence the nutritional status of an individual. Certainly, the clinically observed manifestation of lingual edema, papillary atrophy and glossitis is evidence of the considerable effect that vitamin B complex has on oral tissues. Although the mechanism by which these changes are brought about is not clearly understood, a possible explanation is the demonstration by Adams[8] of a decreased utilization of oxygen by the skin of rats rendered deficient in riboflavin. Such an altered oxidative ability of epithelial tissues might well render them

Much of the experimental work referred to in this report was made possible through support by the Research and Development Division, Office of the Surgeon General, Department of the Army, under Contract No. DA-49-007-MD-506.

Presented as part of a symposium, "Oral Cancer—Clinical Implications of Recent Research" before the Section on Research, ninety-seventh annual session, American Dental Association, Atlantic City, N. J., October 1, 1956.

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†Assistant professor of oral pathology, Medical College of Virginia, School of Dentistry.

1. Thoma, K. H. Oral pathology, ed 4. St. Louis, C. V. Mosby Co., 1954, p. 1448.

2. Hertz, J. Oral precancerous lesions. Oral Surg., Oral Med. & Oral Path. 9:687 July 1956.

3. Eddy, W., and Dalldorf, G. The avitaminoses, ed. 3. Baltimore, Williams and Wilkins Co., 1944, p. 144.

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7. Orr, I. M. Oral cancer in betel nut chewers in Travancore; its aetiology, pathology and treatment. Lancet 2:575 Sept. 9, 1933.

8. Adams, P. D. Oxygen uptake and composition of skin of rats in vitamin G deficiency. J. Biol. Chem. 116:641 Dec. 1936.

more reactive to extrinsic irritants and thereby predispose to malignant change.

Other suggested predisposing factors frequently cited in the literature are syphilis and galvanism.[9,10] With respect to the former, it should be emphasized that the relation probably exists only insofar as the tongue is concerned. Apparently, the nature of syphilitic glossitis is such as to encourage malignant transformation. In galvanism, no such geographic limitation obtains. As suggested by Lain,[11] the saliva of the mouth may set up electrogalvanic currents between dissimilar metals and initiate leukoplakic changes wherever burning occurs. A more striking example of the tissue selectivity of certain predisposing factors is the effect of sunlight. Certainly, the high incidence of lip carcinoma among outdoor workers is evidence of the effect of prolonged tissue exposure to actinic rays.[12]

More difficult to evaluate as a predisposing factor in mouth cancer is the effect of genetics. However, such examples as sex differences in incidence and racial influences (colored versus white) on susceptibility to leukoplakia demonstrate the importance of genetic background.

Unfortunately, the acceptance of many factors as predisposing to oral cancer has been based entirely on clinical evidence. Obviously, such relationships cannot often be authenticated because of the difficulty of establishing adequate methods of control and valid interpretation of data. Furthermore, as alluded to previously, it is often impossible to determine whether a particular factor or agent is predisposing or exciting. In some respects, tobacco may be included in this category. It is interesting to note, for example, that despite the suggestive evidence that tobacco is irritating to mucous membranes, there is no evidence that oral leukoplakia and cancer has shown an increase to parallel the growing use of tobacco in recent years. On the other hand, mounting statistical evidence suggests that lung cancer shows such a relationship.[13,14] It appears, therefore, that varying environmental conditions prevailing at different tissue sites may, in themselves, be protective or otherwise lessen the predisposition of cells to undergo malignant transformation.

In the reviewed literature, Roffo[15] was the first to study experimentally the effect of tobacco on oral tissues and evaluate other factors that, in combination, might predispose to cancer. When the gingiva of rabbits was exposed to tobacco extract, no changes were observed. When daily applications were made in the form of whole smoke, however, leukokeratotic lesions appeared within 25 days. Other animals receiving injections of 0.5 ml. of a 5 per cent cholesterol solution every other day, showed an accelerated appearance of gingival lesions, but when cholesterol administration was limited to the presmoking period, the development of leukoplakia was considerably delayed.

The possible relation of certain hormones to oral leukoplakia and cancer has been suggested principally through the observations of Nathanson and Weisberger.[16] They had noted that leukoplakia of the mouth was oftentimes associated with disturbances in the menstrual cycle and the menopause; therefore, these investigators administered estradiol to both women and men exhibiting this oral

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10. Hazel, O. G.; Charles, G. W., and Diamond, L. E. Leukoplakia buccalis. Arch. Dermat. & Syph. 61:781 May 1950.

11. Lain, E. S. Lesions of oral cavity caused by physical and by physicochemical factors. Arch. Dermat. & Syph. 41:295 Feb. 1940.

12. Molesworth, E. H. Die Behandlung des Haut-und Lippenkrebses. Dermat. Wchnschr. 99:1134 Sept. 1, 1934.

13. Hammond, E. C., and Dorn, D. The relationship between human smoking habits and death rates. J.A.M.A. 155:1316 Aug. 1954.

14. Haenszel, W., and Shimkin, M. B. Smoking patterns and epidemiology of lung cancer in the United States; are they compatible? J. Nat. Cancer Inst. 16:1417 June 1956.

15. Roffo, A. Leucoplasie expérimentale produite par le tabac. Rev. Sud-am. de med. et de chir. 1:321 April 1930.

16. Nathanson, I., and Weisberger, D. Treatment of leukoplakia buccalis and related lesions with estrogenic hormones. New England J. Med. 221:556 Oct. 12, 1939.

lesion. Significantly, the great majority responded most favorably; however, discontinuation of treatment was followed by reappearance of the leukoplakia. Previous to this publication, Ziskin[17] had demonstrated a keratogenic and proliferative effect of both estrogen and testosterone on the gingiva of monkeys and humans. It is of interest to note that recent studies by Nutlay and co-workers[18] confirmed this observation in old mice, but failed to show epithelial changes in young and growing animals.

EXPERIMENTAL STUDIES

In an effort to evaluate several of the factors enumerated in the previous brief review, a series of experiments were undertaken. Both mice and hamsters were used and various groupings were established in accordance with sex, strain, nature of diet, type of irritant tested, tissue site of exposure, gonadal hormone function and local environmental conditions in the mouth. In the initial evaluation of the effect of whole tobacco smoke on the mucocutaneous lip region of Swiss and C57 strain mice, it was found that little or no tissue change occurred even after daily exposures extending up to one year.[19] Of significance is that similar treatment of the ear caused severe tissue change characterized chiefly by hyperkeratosis, epithelial hyperplasia, acanthosis, and chronic inflammation of the corium. Parallel studies on littermates were carried out in order to determine what influence vitamin A and B deficiency, as well as gonadectomy, have on tissue susceptibility to the tobacco irritant. It is of interest to note that whereas the ears of vitamin-deficient mice showed a considerably accelerated and more severe reaction, the lips continued to be unaffected. The influence of orchiectomy and ovariectomy was also striking in that an appreciable degree of cutaneous tissue resistance ensued, even in instances of superimposed vitamin deficiency.

On the basis of the described findings, it seems that oral tissues (lips of mice) either have an inherently greater resistance to tobacco irritants than do cutaneous tissues (ears), or possess the benefit of a protective effect exerted by the tongue and saliva in readily removing deposited tars. Certainly, the question of oral cancer as related to such possible protective factors, is essential to an understanding of what constitutes predisposition to oral malignancy.

After the observation that vitamin B complex deficiency has a pronounced influence on cutaneous tissue response to tobacco irritants but none on oral tissues, additional study was instituted in order to determine which components of the B complex were most related to tissue susceptibility. Results of these experiments showed that riboflavin, pyridoxine and pantothenic acid are of most significance. Negative findings with respect to nicotinamide and thiamine are not surprising in light of the known resistance of mice to deficiency of the amide and the rarity of cutaneous manifestations in deficiency of vitamin B_1.[20]

At the approximate time of the aforementioned studies, Wynder, Graham and Croninger[21] presented evidence that mice require an exposure to cigarette tar for about one half their life span (average of 71 weeks) before skin carcinomas appear. Accordingly, additional animals were subjected to prolonged treatment with whole tobacco smoke. Seventy-five CAF_1 and Swiss strain mice, eight weeks of age at the beginning of the experiment, were divided into several groups accord-

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18. Nutlay, A. G., and others. Effect of estrogen on the gingiva and alveolar bone of molars in rats and mice. J. D. Res. 33:115 Feb. 1954.

19. Kreshover, S. J. The effect of tobacco on epithelial tissues of mice. J.A.D.A. 45:528 Nov. 1952.

20. Kreshover, S. J. Further observations on the effect of tobacco on epithelial tissues of vitamin-deficient mice. J.D. Res. 34:798 Dec. 1955.

21. Wynder, E. J.; Graham, E. A., and Croninger, A. B. Experimental production of carcinoma with cigarette tar. Cancer Research 13:855 Dec. 1953.

ing to sex, nature of diet (normal and vitamin B deficient) and whether gonadectomized or not. After 19 months (76 weeks) of daily application of whole tobacco smoke to the lips and ears, the former tissue continued to show no evidence of pathologic change. In striking contrast were the lesions that appeared on the ears. In the case of vitamin B deficient CAF_1 mice treated for periods exceeding 17 months, there was frequent evidence of such cellular abnormality as to suggest either precancerous change or carcinoma *in situ*. Present in the corium were nests of epithelium with large and oftentimes bizarre nuclei, dark staining nucleoli, prominent chromatin material and frequent mitoses. Similar cells were also found bordering sebaceous glands. The overlying epidermis showed loss of basal cell polarity, hyperplasia and hyperkeratosis.

Although the ears of all mice subjected to prolonged treatment with tobacco showed pathosis, the Swiss strain was less affected than the CAF_1 strain, and animals on a normal diet were somewhat less susceptible than were animals that were deficient in vitamin B. Of additional interest was the observation that gonadectomy caused no significant difference in susceptibility. Seemingly, its beneficial effect is limited to a rather short postoperative period, or else the cumulative effect of daily applications of tobacco over a long period of time is sufficient to negate any protective influence. It is conjectural, therefore, to what degree, if any, gonadectomy might influence the predisposition of oral tissues to carcinogenesis.

Inasmuch as applications of whole smoke to oral tissues of mice are limited by animal size to the lip area, correlative experiments were indicated in a larger species in order to permit intraoral procedures. Grouped in accordance with such categories as sex and diet (normal and vitamin B deficient), hamsters of the golden and albino strains had their palatal mucosa subjected to daily applications of tobacco or triweekly paintings with 3,4 benzpyrene in acetone. Parallel treatments were given to the ears of the same animals. After 16 months' observation of the tobacco-treated group, no oral changes were noted. On the other hand, the ears became keratotic and hyperplastic. In the benzpyrene-treated hamsters, six months' observation showed a similarly negative oral tissue, whereas the ears showed ulceration, thickening and occasional papillomatous formation. Although the duration of this study has been too short to justify conclusions, it would appear that intraoral tissues of hamsters are just as resistant to the effects of known and suspected carcinogenic agents as are the lips of mice.

As suggested in connection with the failure to produce oral lesions in mice, it may be that saliva contributes appreciably to the degree of tissue resistance to various irritants. To evaluate this possibility, the major salivary glands of 22 hamsters were extirpated and the palatal mucosa then subjected to daily applications of tobacco in the form of whole smoke. After 16 months of observation, the oral tissues were entirely free of pathologic change. It should be emphasized, however, that the minor secreting glands of the palate and buccal mucosa are sufficient to provide appreciable lubrication. For this reason, correlative procedures were carried out on the pouches of 40 additional hamsters. Seemingly, the pouch mucosa provides an ideal site for comparative study because of the unique feature that it is an oral tissue devoid of glandular elements and removed from the environmental influence of tongue activity and salivary flow. After eight months of daily applications of whole smoke, the pouches showed a slight to moderate degree of injection and edema.

Previous studies on 36 hamsters treated with 3,4 benzpyrene, 20-menthylcholanthrene, and 9,10-dimethyl-1,2-benzathracene showed production of pouch carci-

nomas in the relatively brief period of from 7 to 25 weeks.[22] Additional female and male hamsters were respectively implanted with 25 mg. pellets of estradiol benzoate and testosterone propionate in their axillae. This procedure was followed by triweekly painting of the pouch areas with 3,4 benzpyrene. Epidermoid tumors became evident after approximately 17 to 18 weeks of treatment. A similar time interval that was required for production of tumors in a parallel series of unoperated animals is evidence that increased sex hormone levels have no apparent influence in promoting oral carcinogenesis. In contrast to this observation, Gilmour[23] and Paletta and Max[24] demonstrated a significantly increased incidence and decreased latent period for production of cutaneous tumors in male and female mice treated with estrogenic hormone as a supplement to benzpyrene and methylcholanthrene application. Seemingly, these reports provide further evidence of the complicated nature of oral tissue response to irritants.

In any consideration of factors predisposing to oral cancer, particularly when related to the possible carcinogenic potential of tobacco, the question of heat necessarily warrants attention. It is of interest to note, therefore, that the average temperature rise at the sites of whole smoke application in mice and hamsters was but 1.8° C. above the average body surface temperature. Such a minor elevation is not surprising in light of the long distance of smoke travel from its burning source. It is of more significance, however, to note that although the temperature at the burning end of a cigarette in human use is approximately 400° C. (650° during a puff), it drops to 60° after passing through but one half inch of the cigarette. The drop continues until, with a mere 2.5 cm. of cigarette remaining, the temperature at the mouth end is about 37°. In light of this extremely slight temperature rise, it is extremely unlikely that heat is a significant factor in oral lesions associated with the use of cigarettes.

SUMMARY

As indicated in this brief review of predisposing factors in oral cancer, most of the information is based on clinical impression. Inasmuch as this makes evaluation extremely difficult, particularly when conclusions are based on impression and conjecture rather than fact, a series of experimental studies were carried out. Although the fallacy is recognized of attempting to make clinical application of observations made of the laboratory animal, a number of interesting observations may be recorded.

1. The mucocutaneous lip region of mice is unaffected by daily exposures to whole tobacco smoke after periods of observation covering 19 months (76 weeks). Factors of sex, strain and vitamin A and B deficiency have no apparent influence on this tissue resistance.

2. In contrast to the resistance manifested by lip tissue, the ears of mice are noticeably susceptible to daily applications of tobacco smoke. Although ulceration, hyperkeratosis and hyperplasia are manifested early, a precancerous type of lesion frequently becomes evident after 17 months of treatment.

3. The severity of cutaneous change in mice is considerably increased when animals are rendered deficient in vitamins A and B complex.

4. The CAF_1 strain of mouse is more susceptible to skin irritation from tobacco than is the Swiss or C57 strain.

5. Gonadectomy in mice causes some increased skin resistance to tobacco irri-

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24. Paletta, F. X., and Max, P. F. Influence of estradiol benzoate on epidermal methylcholanthrene carcinogenesis. J. Nat. Cancer Inst. 2:577 June 1942.

tants. For periods exceeding 3 months' exposure to tobacco, this protective effect is not evident.

6. The intraoral (palatal) tissues of hamsters are unaffected by either daily exposures to whole tobacco smoke or triweekly applications of 3,4 benzpyrene, periods of observation being 16 and 6 months respectively. Factors of sex, strain, vitamin B deficiency and desalivation have no apparent influence on this tissue resistance.

7. In contrast to the resistance manifested by the hamster palate, the cheek pouch shows injection and edema after eight months of tobacco applications, and epidermoid carcinoma after 4 months of benzpyrene painting.

8. Increased gonadal hormone function in hamsters does not apparently influence the pattern of benzpyrene-induced carcinogenesis in the cheek pouch.

9. The factor of heat from cigarette smoking is probably of no significance in causing injury to oral tissues.

10. It is probable that saliva and tongue activity contribute significantly to the resistance of oral tissues to various irritants.

THE EXPERIMENTAL PRODUCTION OF ORAL MALIGNANCIES

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The ultimate conquest of malignant disease will depend on an understanding of the biology of neoplastic processes. That understanding will come from experimental studies in the various fields of growth, differentiation and development. Whereas cancer research *per se* is only about 50 years old, the literature concerning the experimental aspects of malignant growth has been extensive. A compilation of that literature between 1900 and 1930 lists over 12,000 references,[1] and in the last 25 years there has been an increasing number of publications in the field. Obviously space will not permit a comprehensive critical review of the literature, but some of the more fundamental aspects of experimental carcinogenesis must be elaborated if the problem of intraoral malignant growth is to be understood.

As Cowdry[2] points out, the cancer problem, especially when studied on a cellular level, cannot be taken up in an orderly fashion. In experimental carcinogenesis, apparently localized small groups of cells are being dealt with. It must be recognized, however, that no matter how small the group or how well localized the cells under consideration may seem, they are an integral part of the individual, and as such they are influenced by their neighboring cells as well as by their more distant relatives.

Many factors influence the susceptibility of the cell to the initiating action of carcinogens. Cells react to a carcinogenic agent according to their genetic background. The "constitutional" susceptibility of the cells to the action of carcinogens, with consideration of the latent

The original work reported here was supported in part by a grant from the National Cancer Institute (C.1109), National Institutes of Health and American Cancer Society (ENV-2) through the Committee on Growth, National Research Council.

Presented as part of a symposium, "Oral Cancer—Clinical Implications of Recent Research" before the Section on Research, ninety-seventh annual session, American Dental Association, Atlantic City, N.J., October 1, 1956.

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2. Cowdry, E. V. Cancer cells. Philadelphia, W. B. Saunders Co., 1955.

period and promoting or inhibiting factors, is a little understood but important aspect of experimental cancer research. Also important are the species of animal used and the conditioning action of the tissue fluid environment of the cells. Additional considerations of interest to investigators, especially to those concerned with carcinogenesis of the mouth, are: the accessibility of the cell to the action of the carcinogen; the ability of the cell to evacuate chemical carcinogens or to convert them to harmless substances, and the type of cell involved, whether intermitotic, postmitotic or reverting postmitotic.

For those interested in the problem of experimental oral cancer one question to be dealt with is: do the cells of the oral mucosa differ in their reactions from the cells of the epidermis? The environment of the epithelial cells lining the mouth is different from that of the epithelial cells lining or covering other areas of the body. This environmental factor might well influence the biology of the oral mucosa in such a way that if oral epithelial cells and skin epithelial cells, for example, were exposed to the same carcinogen, the outcome in the two instances would be remarkably different.

Much work has been done in the field of experimental skin carcinogenesis. (A review of the literature on this aspect has been done by Cowdry[3] and Shear.[4]) It has been observed that when methylcholanthrene dissolved in benzene is applied to the skin of mice, it promptly makes its way into the sebaceous glands and later spreads to the intermitotic epidermal cells. Yet the intermitotic cells of the sebaceous glands undergo malignant change less frequently than do those of the epidermis and hair follicles, indicating a greater "constitutional" resistance to the carcinogen.[2]

If the skin of newborn mice is painted with the carcinogen methylcholanthrene in benzene, no epidermoid carcinomas develop. If the skin of five day (or older) mice receives a similar application of the same carcinogen, epidermoid carcinomas do develop. The epidermis of newborn mice is thick, and the hair follicles and sebaceous glands are wholly absent or rudimentary. By the fifth day of life, skin appendages are formed. These facts led Cowdry[2] to conclude that the carcinogen sinks into the pits afforded by the hair follicles, enters the sebaceous glands, and from this location "attacks the epidermal cells from the rear." Lacassagne and Latarjet[5] found that the skin of mice freed of hair follicles and sebaceous glands by scarring was refractory to the carcinogenic action of methylcholanthrene. The skin of normal adult mice, however, when painted with single or multiple applications of methylcholanthrene and other chemical carcinogens, developed epidermoid carcinomas.

In order to compare the histologic reactions of skin and oral mucous membrane to a known carcinogen, Levy and co-workers[6] made a single application of dimethyl benzanthracene in benzene to the skin and mucous membrane of the lower lip of mice. The lower lip seemed to be ideally situated for such a study since the epithelium covering the skin and the mucosa could be studied in the same section. After the application of the carcinogen, the animals were sacrificed at regular intervals up to 32 days. Although the skin surface of the lip showed the changes described by other investigators as typical of precancerous lesions of other areas of skin, the mucosal surface of the lip was completely refractory to the carcinogen. Additional studies by

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5. Lacassagne, A., and Latarjet, R. Action of methylcholanthrene on certain scars of skin in mice. Cancer Research 6:183 April 1946.

6. Levy, B.; Gorlin, R., and Gottsegen, R. Histology of early reactions of skin and mucous membrane of lip of mouse to single application of a carcinogen. J.Nat.Cancer Inst. 12:275 Oct. 1951.

Levy[7] showed that repeated paintings of carcinogenic agents onto the mucous membrane of the lip and tongue of mice and hamsters for periods up to six months resulted in epidermoid carcinomas developing on the perioral skin, but not on the mucous membrane. Kolas[8] was also unable to produce carcinomas of the oral epithelium of mice, and Van Prohaska[9] and co-workers reported only one carcinoma of the cheek of a mouse fed methylcholanthrene in olive oil for approximately six months.

There are at least two possible explanations for the resistance of the mucous membrane to topical applications of carcinogens. One is that the oral fluids may act as an inhibitory or protective substance in intraoral carcinogenesis. The other is that since there are no sebaceous glands or hair follicles in the oral mucosa, there is no portal of entry for the dissolved carcinogen. To test the second theory, an aqueous suspension of methylcholanthrene was injected beneath the mucosa of the tongue in a large series of animals.[10] Two types of response were noted. One occurred in the controls injected only with cellusol as well as in the animals injected with methylcholanthrene in cellusol and was interpreted as being histologically similar to the granular cell myoblastoma of man. The other response was the appearance of typical epidermoid carcinomas.

Because the biology of the oral mucosa has not been extensively studied, a final answer cannot be given to the question of why oral epithelium and skin epithelium react differently to local applications of chemical carcinogens. It does seem certain, however, that a portal of entry is necessary, as demonstrated by the circumstance that tongue epithelium is resistant to methylcholanthrene when it is applied topically, but undergoes malignant transformation when the carcinogen is injected beneath it.

There have been several successful attempts to produce carcinomas in the cheek pouch of hamsters.[11,12] That research work is not reviewed here, however, since the cheek pouch is probably not a true intraoral mucous membrane.

A type of tumor that is of special interest to dentists is the ameloblastoma. An attempt was made to produce this tumor experimentally in hamsters and mice[7,10] by implanting pellets of dimethyl benzanthracene or of methylcholanthrene beneath the fundic bone at the growing end of the lower incisor tooth of these animals. No ameloblastomas were produced, but fibrosarcomas developed in the jaws of hamsters and osteosarcomas in the jaws of mice.

The failure to stimulate the ameloblasts to tumor formation may be explained in terms of the nature of the ameloblast. The explanation requires some understanding of cell types. Cells are classified as intermitotic or postmitotic. The intermitotic cells are of two types, vegetative and differentiating. The vegetative types are at the lowest level, represented by spermatagonia and other basal epidermal cells. Differentiating intermitotic cells are daughter cells of the vegetative type which developed different properties distinguishing them from their antecedents. Spinous cells of the epidermis and spermatocytes in the testicle are examples of differentiating intermitotics. Postmitotic cells are at the top of the ladder of differentiation. They discharge the function for which they were designed and, having done so, die (fixed postmitotic) or revert to an intermitotic

7. Levy, B., and Ring, J. R. Experimental production of jaw tumors in hamsters. Oral Surg., Oral Med. & Oral Path. 3:262 Feb. 1950.

8. Kolas, S. Investigation of normal human saliva for possible anticarcinogenic action and chemical carcinogenesis in mucous membranes. Oral Surg., Oral Med. & Oral Path. 8:1192 Nov. 1955.

9. Van Prohaska, J.; Brunschwig, A., and Wilson, H. Oral administration of methylcholanthrene to mice. Arch. Surg. 38:328 Feb. 1939.

10. Levy, B. Unpublished work.

11. Chaudry, A. P. Carcinogenesis in the oral mucosa. (Abst.) J.D. Res. 34:750 Oct. 1955.

12. Salley, J. J. Experimental carcinogenesis in cheek pouch of the Syrian hamster. J.D.Res. 33:253 April 1954.

form (reverting postmitotic). The two kinds of intermitotic and the reverting postmitotic cells are considered to be potentially malignant.[2] Ameloblasts perform their function, revert to squamous epithelium and then die. They may thus be considered as falling between the fixed postmitotic and the reverting postmitotic types. They have a limited potential for malignant change; therefore, the failure to stimulate them by chemical carcinogens is understandable. Until more is known about the biology of these cells, however, hypothesis should not be confused with theory.

The physiology of the oral mucosa and its appendages offers a real challenge in the field of biology.

THE ROLE OF SALIVA AND OTHER LOCAL ENVIRONMENTAL FACTORS IN ORAL CARCINOGENESIS

Paul Goldhaber, D.DS., Boston

In 1914 Yamagiwa and Ichikawa succeeded in producing tumors on the ears of rabbits by prolonged painting with coal tar. Approximately 20 years later, Cook and his co-workers[1] found it possible to produce skin cancer by the use of specific hydrocarbons of the benzanthracene group. These findings were of fundamental importance since they offered a method whereby neoplasia could be produced and studied readily in an attempt to understand the mechanism of the cancer process. In the great majority of experiments, the skin was utilized as the tissue of choice, since this site lends itself to the direct application of carcinogens and ready observation of the resulting changes. However, subsequent research revealed that "the 'biological equation' epidermis + chemically pure carcinogen → epidermal cancer in a high percentage of cases is a highly artificial simplification."[2] In addition to the variations observed caused by differences in species, strains, tissues, age, sex, diet or hormonal balance, various extrinsic factors such as fats, oils, irritants, trauma and radiant energy, when applied directly to the experimental site, are capable of modifying the action of carcinogens.[3] Unfortunately, despite the mass of data collected, the information concerning the mechanism of carcinogenesis is still fragmentary, and frequently contradictory. It is the purpose of this paper to discuss some of the prevalent ideas about the mechanism of carcinogenesis in skin as compared with the special problem posed by the oral mucosa, especially with reference to the role of saliva and other local environmental factors.

MECHANISM OF CARCINOGENESIS

Since a single cutaneous application of 20-methylcholanthrene can result in the development of a carcinoma in Swiss strain mice,[4] knowledge of the eventual

The original work reported here was supported in part by a grant from the National Cancer Institute of the United States Public Health Service (C-2083) (C3) M & G (5) and an American Cancer Society Institutional Grant, Harvard University.

Presented as part of a symposium, "Oral Cancer—Clinical Implications of Recent Research," before the Section on Research, ninety-seventh annual session, American Dental Association, Atlantic City, N. J., October 1, 1956.

Associate in oral pathology, U.S.P.H.S. senior research fellow, Harvard School of Dental Medicine.

1. Cook, J. W., and others. Production of cancer by pure hydrocarbons. Proc. Roy. Soc., London, s.B 111:455 Oct. 1, 1932.

2. Cowdry, E. V. Epidermal carcinogenesis. In Advances in cancer research. New York, Academic Press, Inc., 1953, vol. 1, p. 57-101.

3. Rusch, H. P. Extrinsic factors that influence carcinogenesis. Physiol. Rev. 24:177 April 1944.

4. Simpson, W. L., and Cramer, W. Further observations on skin carcinogenesis by single application of 20-methylcholanthrene. Cancer Research 3:604 Sept. 1943.

localization of the carcinogen in the tissue would be of extreme interest.

Simpson and Cramer,[5] taking advantage of the characteristic fluorescing property of methylcholanthrene, studied the absorption, distribution and persistence of this material by means of fluorescence microscopy. Within several minutes after the application of methylcholanthrene to the skin of mice, the carcinogen appeared to be concentrated primarily in the sebaceous glands and the free lipids of the keratin layer. In addition, incrustation of dry carcinogen was found on the skin surface and hair. Several days later the sebaceous glands began to degenerate and disappear, accompanied by a massive excretion of sebum containing carcinogen into the hair follicles and onto the surface of the skin. After approximately one week, the fluorescence due to the carcinogen had completely disappeared. From this point on, the final fate of the carcinogen is unknown. It is of interest that the unaltered carcinogen failed to penetrate the living cells of the deeper layers of the epidermis, although a second application two weeks later did permit the unchanged carcinogen to enter the cytoplasm, suggesting some alteration in the cells due to the initial application.[6] With regard to the malignant change which eventually occurs after a single application of carcinogen, it may be that the carcinogen acts at the cell surface or else some of its breakdown products which no longer show the characteristic fluorescence might pass into the cells unnoticed.[7]

It is also possible that the cells that eventually become malignant were never themselves directly in contact with the carcinogen, but are only the unfortunate progeny. Recent biochemical work[8] lends support to the protein or enzyme-deletion theory which suggests that the carcinogen combines with certain proteins essential for the control of growth. By blocking the synthesis of these proteins without killing the cell, new cell generations might arise free of the normal growth-controlling factors and eventually manifest themselves as tumors.

These views are compatible with the theory that carcinogenesis involves at least two separate and distinct phases:[9-11] (1) an initiating process, wherein some normal cells (or their progeny) are converted into latent tumor cells in a relatively short period of time by a carcinogen, and (2) a promoting process, wherein these dormant tumor cells are stimulated to grow into visible tumors after a longer period of time by repeated applications of croton oil or other irritants.

In other words, the potentiality for tumor formation is determined by the ability of the carcinogen to convert some normal cells to tumor cells, whereas the length of time it takes for a visible tumor to appear may be determined by the subsequent action of a noncarcinogen such as croton oil.

This action by a noncarcinogenic agent has been termed "cocarcinogenic action." It should be noted that multiple applications of a carcinogen exert both initiating and promoting actions, whereas a cocarcinogen is capable only of the latter and cannot produce tumors by itself. Furthermore, in order for the cocarcinogen to have its effect it has to be applied subse-

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7. Cowdry, E. V. Experimental epidermal methylcholanthrene carcinogenesis in mice. Biol. Symposia 10:131, 1943.

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10. Berenblum, I., and Shubik, P. A new, quantitative, approach to the study of the stages of chemical carcinogenesis in the mouse's skin. Brit. J. Cancer 1:383 Dec. 1948.

11. Rusch, H. P. An integrated concept of carcinogenesis. In Currents in biochemical research 1956, Green, D. E., editor. New York, Interscience Publishers, Inc., 1956, p. 675-697.

quent to the carcinogen.[12] Recently, however, the existence of cocarcinogens has been challenged on the basis that such agents are capable of both initiating and promoting the growth of tumors. Poel[13] states:

> It would appear that, with the possible exception of trauma, what have been termed cocarcinogens are probably tumor-producing agents tested under conditions that did not disclose their potency as tumor initiators.

COMPARISON OF ORAL MUCOSA AND SKIN

In view of the relative ease with which skin tumors in mice can be elicited by topical applications of a carcinogen, it may seem surprising that similar applications to their oral mucosa have failed to produce intraoral tumors.[14-16] Various explanations have been offered for these negative results. Levy and co-workers[14] have suggested two possible reasons for the resistance of the mouse oral mucous membrane to carcinogens: the lack of a portal of entry due to the absence of sebaceous glands and the presence of a protective layer of mucus. Kreshover,[15] working with tobacco smoke, has stressed the action of the tongue and saliva in removing deposited tars. Recently, Kolas[16] has concluded that the failure to develop tumors in the oral cavity was due in part to the continuous diluting and cleansing action of saliva. His attempt to show that saliva *per se* had an anticarcinogenic action was unsuccessful.

In view of the prominent position accorded to the local action of saliva in protecting the oral mucosa from the action of carcinogens, our laboratory at the Harvard School of Dental Medicine set out to test the effect of multiple applications for approximately 3 months of 0.3 per cent 3-methylcholanthrene in acetone dropped on the labial mucosa of mice after the surgical removal of their major salivary and lacrimal glands. This operative procedure appeared to be extremely effective in decreasing the local cleansing action of saliva, particularly in the region of the labial mucosa where the carcinogen was applied. In addition, since the solution invariably spread over the adjacent skin, it was possible to compare the response of the oral mucosa to that of the skin. During the first eight and one half months of this experiment, on the basis of gross and microscopic examination of the animals which were periodically sacrificed, it appeared that desalivation did not significantly alter the resistance of the labial mucosa to the topical application of the carcinogen. Extraorally, however, desalivation apparently enhanced the occurrence of skin tumors. This latter finding could be explained by the inability of the mice to cleanse themselves properly, which thereby permitted higher concentrations of the carcinogen to act over a longer period of time. This conclusion appears reasonable since it has been shown by others[17] that the rate of disappearance of benzpyrene from the skin is very rapid, approximately 80 to 90 per cent of the carcinogen being removed from the skin within one hour by the animals licking themselves and each other.

In reporting the progress on the work recently,[18] it was concluded that the local action of saliva *per se* apparently does not explain the resistance of the labial mucosa to a carcinogen, and that the

12. Berenblum, I. Mechanism of carcinogenesis: study of significance of cocarcinogenic action and related phenomena. Cancer Research 1:807 Oct. 1941.

13. Poel, W. E. Cocarcinogens and minimal carcinogenic doses. Science 123:588 April 6, 1956.

14. Levy, B. M.; Gorlin, R. J., and Gottsegen, R. Histology of early reactions of skin and mucous membrane of lip of mouse to single application of carcinogen. J. Nat. Cancer Inst. 12:275 Oct. 1951.

15. Kreshover, S. J. Effect of tobacco on epithelial tissues of mice. J.A.D.A. 45:528 Nov. 1952.

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17. Calcutt, G., and Powell, A. K. Control of some factors involved in experimental epidermal carcinogenesis. Brit. J. Cancer 1:323 Sept. 1947.

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difference in response of skin and labial mucosa appeared to be related to their anatomic differences. Whereas the skin affords an excellent portal of entry for the carcinogen through the hair follicles and sebaceous glands, the labial mucosa does not contain these structures. Instead, the labial mucosa consists of many layers of epithelial cells covered by thick, dense keratin. It appeared possible that this barrier could prevent certain carcinogens from penetrating to the deeper cell layers which have the potentiality of responding to the action of carcinogens.

It should be noted, however, that the removal of the major salivary glands, by leading to the impaction of food, hair and debris in the labial sulcus, indirectly affected the anatomy of the labial mucosa, since the trauma and chronic irritation frequently resulted in areas of superficial ulceration as well as areas of hyperkeratoses.

These indirect effects of desalivation have become increasingly significant in view of our most recent findings in mice sacrificed 10 to 12 months after the initial application of carcinogen. Histological examination revealed that three of the five remaining desalivated mice treated with carcinogen had developed early carcinoma of the labial mucosa associated with chronic ulceration, whereas no malignant changes were found in the labial mucosa of the remaining 18 unoperated animals treated with carcinogen. It appears evident, therefore, that under the conditions of desalivation, and given sufficient time, the mouse labial mucosa is capable of developing carcinoma after the topical application of a carcinogen.

The findings also suggest that the chronic ulceration, caused by the continuous trauma of food and hair impaction, may play an important role in the carcinogenic process by acting as a cocarcinogen, a portal of entry, or both.

In comparing the relative differences in susceptibility to carcinogens between oral mucosa and skin, it should be noted that in certain instances the mouse epidermis may be resistant to carcinogens. This has been shown for the soles of the feet[19] and the epidermis of newborn mice.[20] It is significant that at both sites, the anatomic picture is similar to that of the labial mucosa of the mouse, presenting a thickly keratinized, well-differentiated epidermis and immature or absent sebaceous glands and hair follicles. Furthermore, it has been shown that destruction of the hair follicles and sebaceous glands by ultraviolet irradiation or by the removal of a cutaneous disk in mice, apparently made the skin area refractory to methylcholanthrene.[21] It has been suggested recently that the hair follicles are the primary site of the neoplastic response.[22] However, the role of the hair follicles and sebaceous glands in epidermal carcinogenesis is still unsettled.

The problem becomes even more complicated when other species are considered. Rat epidermis has been shown to be relatively resistant to the application of carcinogens, in spite of the fact that methylcholanthrene readily enters the sebaceous glands. This apparent paradox may be explained by the observation that, unlike the sebaceous glands of mice which are destroyed within several days after a single application of a carcinogen, those of the rat persist even after 36 paintings.[23] In view of the inhibition of the carcinogenic activity of methylcholanthrene when dissolved in anhydrous lanolin[24] (the secretion of the sebaceous

19. Twort, J. M., and Twort, C. C. Variable sensitivity of different sites of skin of mice to carcinogenic agents. J. Path. & Bact. 42:303 Jan. 1936.

20. Suntzeff, V.; Carruthers, C., and Cowdry, E. V. Role of sebaceous glands and hair follicles in epidermal carcinogenesis. Cancer Research 7:439 July 1947.

21. Lacassagne, A., and Lataijet, R. Action of methylcholanthrene on certain scars of skin in mice. Cancer Research 6:183 April 1946.

22. Liang, H., and Cowdry, E. V. The role of hair follicles in methylcholanthrene carcinogenesis in mice. J. Nat. Cancer Inst. 16:205 Aug. 1955.

23. Cambel, P. Fluorescence studies of carcinogens in rat skin. Cancer Research 11:370 May 1951.

24. Simpson, W. L., and Cramer, W. Sebaceous glands and experimental skin carcinogenesis in mice. Cancer Research 3:515 Aug. 1943.

glands of the sheep), it appears possible that the sebum within the intact sebaceous glands of the rat skin prevents the carcinogen from acting. On the other hand, the mucosa of the hamster's cheek pouch, although similar in appearance to the labial mucosa of the mouse, is very susceptible to the action of carcinogens.[25] This may be explained on the basis of prolonged action of the carcinogen in a region from which it is not readily removed by the activity of the tongue or salivary flow. The observation that a short period of degeneration with necrosis and some sloughing was followed by a short period of regeneration while carcinogens were being applied[26] may be significant, since such a response has not been described for the mouse oral mucosa.[14] It is possible that this temporary destruction of the "physiological barrier" might contribute to the susceptibility of the hamster cheek pouch epithelium to carcinogenic action.

In order to test the hypothesis that a "physiological barrier" exists in the mouse labial mucosa, it was decided to study the localization of 3-methylcholanthrene by means of fluorescence microscopy. One to two drops of the carcinogen were applied to both the mucosa and skin of the lower lip. The animals were sacrificed ten minutes later, after which the lower lip was removed and frozen sections were prepared. The sections were cleared and mounted in glycerol and examined the same day. Formalin fixation was found to be unsatisfactory since the autofluorescence was increased. Our findings on the skin side of the lip were similar to those of Simpson and Cramer:[5] the blue-violet fluorescence of the carcinogen was localized primarily within the sebaceous glands, whereas the bright yellow-green fluorescence of the dry carcinogen on the skin surface almost completely masked the blue-violet fluorescence present in the keratin layer (Fig. 1, left). On the mucosal surface, however, the fluorescence was similar to the autofluorescence of the normal control (Fig. 1, right), any slight blue-violet fluorescence found was restricted to the outermost layers of the oral epithelium and the keratin.

There appeared to be no appreciable difference in the distribution of methylcholanthrene whether the animal was sacrificed immediately or one hour after application of the carcinogen. In older, desalivated mice the carcinogen appeared to be selectively adsorbed within those regions possessing an abnormally thickened keratin layer, being sharply demarcated from the dark, underlying epithelium. The same technic was utilized and results similar to those found with normal labial mucosa were observed with the sole of the foot epidermis and with the skin of newborn mice. These findings appear to substantiate the hypothesis that a physiological barrier is present in these particular areas which may account for their resistance to carcinogens. However, other factors may be involved as well in determining the resistance of a tissue to carcinogenic action. The turnover time, or time taken for the replacement of a number of cells equal to that in the whole population,[27] may be such a factor.

FURTHER COMMENTS

It has been pointed out that the variation in response of different species to a carcinogen is only relative, and that skin tumors can be induced even in the monkey, provided the potency is sufficient and duration of treatment with the carcinogen is long enough.[28] Although, obviously, it is not possible to go about

25. Salley, J. J. Experimental carcinogenesis in the cheek pouch of the Syrian hamster. J. D. Res. 33:253 April 1954.

26. Salley, J. J. Histologic changes in the hamster cheek pouch during early hydrocarbon carcinogenesis. Presented before the International Association for Dental Research, St. Louis, March 24, 1956.

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28. Berenblum, I. Carcinogenesis and tumor pathogenesis. In Advances in cancer research. New York, Academic Press, Inc., 2:129-175, 1954.

testing the effect of methylcholanthrene in human populations, there has been overwhelming evidence that other chemical and physical carcinogens can effectively cause neoplasia in human beings, the latent period sometimes lasting as long as 20 to 30 years.[29, 30]

With regard to some of the local environmental factors associated with oral carcinoma, the correlation between chronic mechanical irritation, in the form of jagged teeth or ill-fitting dentures and carcinoma of the buccal mucosa, tongue, or gingiva has been recognized.[31] Experimentally, however, tumors cannot be induced by chronic mechanical irritation alone.[32] Nevertheless, in view of our preceding observations, chronic mechanical irritation may play a vital role in the etiology of oral cancer by virtue of its action as a cocarcinogen or possibly as an agent which breaks down the "physiological barrier" thereby allowing some exogenous carcinogen, such as tobacco, to penetrate to the deeper, susceptible cells.

The fluorescent microscopy studies with methylcholanthrene were extended to the rhesus monkey; these preliminary studies have revealed results similar to

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30. Cowdry, E. V. Cancer cells. Philadelphia and London, W. B. Saunders Co., 1956, Chap. 7, p. 202-242, Chap. 14, p. 379-389.

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32. Berenblum, I. Irritation and carcinogenesis. Arch. Path. 38:233 Oct. 1944.

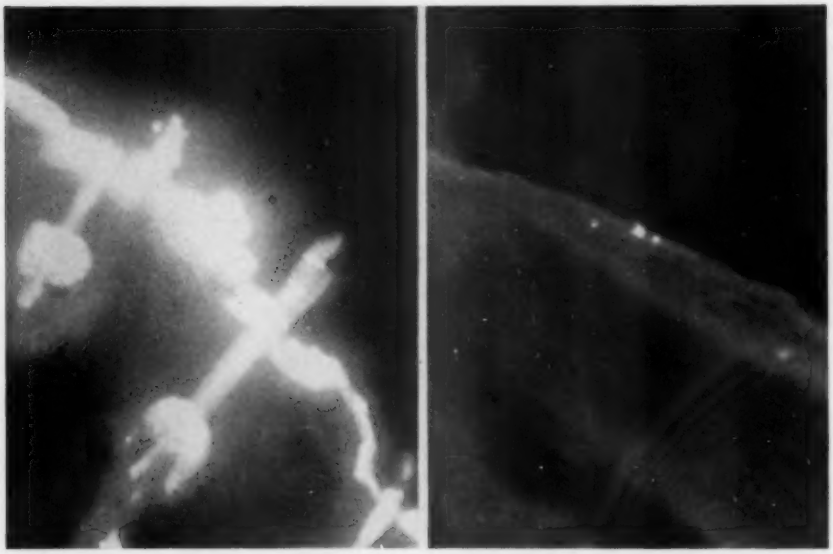

Fig. 1 • Left: Skin side of mouse lip, ten minutes after application of 0.3 per cent of 3-methylcholanthrene in acetone, as seen with fluorescence microscopy. The yellow-green fluorescence of the dry carcinogen trapped on the surface, and the blue-violet fluorescence of the dissolved carcinogen in the sebaceous glands are visualized as white in the black and white print. The greyish haze about the fluorescent areas is an artifact. Right: Mucous membrane side of mouse lip ten minutes after application of 0.3 per cent of 3-methylcholanthrene in acetone as seen with fluorescence microscopy. Note failure of carcinogen to remain on surface or penetrate through the mucous membrane. This area was exposed photographically almost three times as long as Figure 1, left.

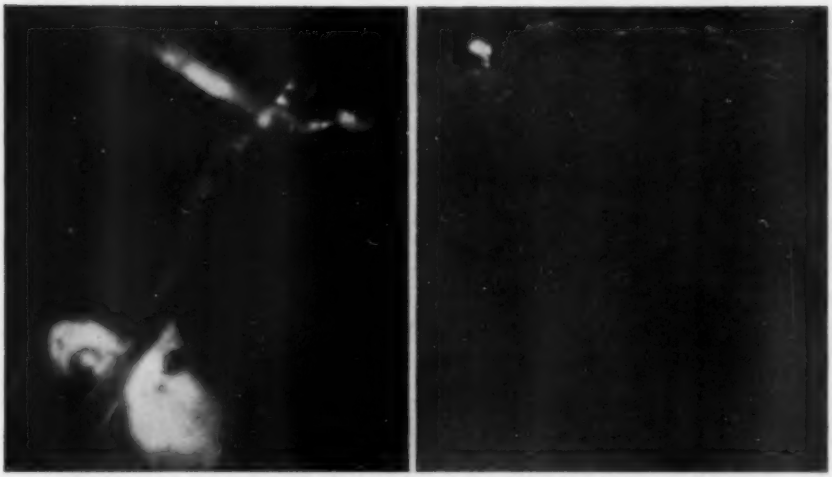

Fig. 2 • Left: Skin side of monkey lip, ten minutes after application of 0.3 per cent of 3-methylcholanthrene in acetone, as seen with fluorescence microscopy. The carcinogen is seen primarily on the skin surface and in the sebaceous glands. The duct of the gland coursing behind the hair shaft appears to contain carcinogen as well. Some dark nuclei may be seen in several of the sebaceous gland cells. Right: Mucous membrane side of monkey lip, ten minutes after application of 0.3 per cent of 3-methylcholanthrene in acetone, as seen with fluorescence microscopy. Some dry carcinogen is seen on the mucosal surface. A slight amount of carcinogen is seen to penetrate the outermost portion of the mucosa, but apparently does not reach the deeper cells.

those found in the mouse. Although the carcinogen readily penetrates into the sebaceous glands on the skin side of the lip (Fig. 2, left), it fails to penetrate throughout the thick epithelium of the labial mucosa (Fig. 2, right). No fluorescence was observed in the underlying mucous glands, indicating that these structures, unlike the sebaceous glands of the skin, do not readily afford a portal of entry. In this connection it might be questioned whether the aberrant sebaceous glands of Fordyce's disease are without clinical significance. Our findings suggest the presence of a "physiological barrier" in the oral mucosa of primates, and possibly in humans, which must be breeched in order for exogenous carcinogens to be effective. In view of the aforementioned hypothesis, the findings of Balendra[33] are most significant. After studying 5,000 instances of buccal carcinoma in betel chewers, he has concluded that betel chewing *per se* does not result in carcinoma. On the other hand, where betel chewing is accompanied by a tilted, knife-edged tooth which results in a traumatic ulcer of the buccal mucosa, gingiva or tongue, these ulcers ultimately become cancerous. In addition, it is conceivable that atrophy of the oral mucosa, as well as ulceration, may permit carcinogens to penetrate the "physiological barrier." In this respect, it is significant that there is a positive correlation between carcinoma of the tongue and the atrophic tongue of Plummer-Vinson's syndrome as well as the smooth tongue of syphilis.[34]

33. Balendra, W. Effect of betel chewing on the dental and oral tissues and its possible relationship to buccal carcinoma. Brit. D. J. 87:83 Aug. 19, 1949.

34. Thoma, K. H. Oral pathology, ed. 4. St. Louis, C. V. Mosby Co., 1954, p. 1471.

SUMMARY AND CONCLUSIONS

An attempt has been made to present some of the present-day concepts concerning the mechanism of carcinogenesis in the skin and labial mucosa of experimental animals. The relative resistance of the oral mucosa of mice to topical applications of carcinogen was explained primarily on the basis of the presence of a "physiological barrier" which prevents the carcinogen from penetrating to the deeper cells which are capable of dividing.

By means of fluorescence microscopy such a barrier appears to be demonstrable in the oral mucosa of the mouse and monkey. The chronic ulceration found in association with experimentally produced oral carcinoma in desalivated mice treated with carcinogen may contribute to the carcinogenic process by virtue of its action as a cocarcinogen, a portal of entry or both. It is possible that chronic ulceration or atrophy may play a similar role in human oral carcinoma as well, providing a carcinogen is present in the environment.

PRACTICAL APPLICATION OF EXPERIMENTAL CANCER RESEARCH

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The hopes of untold thousands of living and yet unborn men and women lie in conquest of the number two disease killer —cancer. Through many centuries, approaches to the control of cancer were gained by experience. Surgeons learned to excise beyond the visible limits of the lesions and, later, to remove related lymph nodes. With the discovery of anesthetics, these procedures became more practical. When the physicist learned to utilize radiant energy, the oncologist applied radium, radium emanations, roentgen rays and radioactive substances in the control of cancer. Today, as a result of clinical application of research, cancer is many times more curable than it was a century ago; however, researchers have only started along the road to cure and elimination of cancer. Science must find the way.

APPLICATION OF SCIENTIFIC METHOD TO CANCER RESEARCH

There are different ways in which the scientific method may be applied to research in cancer. Eventually it may be necessary to unlock the secret of life itself in order to understand cancer. It is known that both embryonic cells and cancer cells divide and multiply, but it is not known why embryonic cells stop dividing when they have developed the tissue or organ for which they serve as an anlage. It is known that after an injury such as extraction of a tooth, the fibroblasts divide, multiply and replace the lost tissue, but it is not known why they stop this accelerated division when they have fulfilled their reparative function whereas cancer cells go on dividing and multiplying without regard for the normal body welfare. This is the basic problem, and scientists are attacking it from many sides. Most of the older technics have been exhausted, but more powerful and different methods of viewing cell structures,

Presented as part of the symposium, "Oral Cancer—Clinical Implications of Recent Research," before the Section on Research, ninety-seventh annual session, American Dental Association, Atlantic City, N. J., October 1, 1956.

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such as the electron microscope and the x-ray microscope, more definite chemical studies, such as offered by histochemistry, more searching physical methods, such as fluorescence and roentgen ray diffractions, and more introscopic technics, such as the use of radioactive tracers, are pushing back the curtains of ignorance. This is the direct approach of research, but it may require years of searching and plodding. The result may not be apparent within the time of any living beings, or the essential facts may already have been discovered in some laboratory waiting only the light of publicity.

Science in a free society does not approach its subject through one channel. A second obvious way to search is to seek better methods of diagnosis, prevention and cure even before the cause of cancer is known. There are several examples of the effectiveness of this technic, but only one or two need be mentioned. When Jenner first vaccinated to prevent smallpox, the cause of smallpox was unknown, although it had been observed that those who developed cowpox remained immune to smallpox. The nature of the disease and its virus etiology were not known for another century, but this clinical approach was already saving multitudes of children from early and unnecessary death. Similarly, the observation that individuals who consumed water with optimal fluoride levels during their years of tooth development have less tooth decay than those raised in low fluoride regions led to the application of fluorides to communal water supplies and the control of tooth decay although it is not yet known how fluorides work in the prevention of caries.

The scientists who follow this approach to cancer control are investigating newer diagnostic tools—hormones, chemicals, vitamins and vitamin antagonists, radiant energy—and other possible factors that might help save lives today and tomorrow.

Still a third line of attack on the cancer problem is to study groups of peoples or groups of individuals who have never had cancer themselves to find out what protects them. Is it intrinsic or is it something in their environment? Such a method of approach, at first, may seem too oblique, but the secret may be in what these people have or do, not in what the cancer victims have or do. Related to this is the current investigation at the Ohio State Penitentiary of the fate of cancer cells implanted into volunteer human experimental subjects.

Cameron[1] described the course of science and scientists in cancer research when he said:

> But research is an effort to penetrate the unknown. No one can predict the course it must take. In the case of cancer we already know enough to realize that here is a problem so large and so intricate that it presents the most formidable challenge ever faced by . . . the biological sciences. For cancer research now embraces every known branch of science concerned with living things. And, as knowledge accumulates, it calls on an increasing number of basic sciences that were once thought to have no relationship whatsoever to cancer.

Dental scientists are carrying their share of the load in this team effort to penetrate the unknown in the cancer field. Cancer of the oral regions probably has the same causes, or cause, as other cancers, its cells probably follow through the same histological history, and the technics for detection, prevention and cure may be the same. Nevertheless, there may be special modifying factors. Whether or not oral cancer exactly duplicates extra-oral cancer, the scientists in and associated with dentistry cannot and do not wait for "George to do it." These dental scientists are attacking the cancer problem from various approaches and, most important, their results are impressive.

As soon as new diagnostic technics such as exfoliative cytology, sponge biopsy, his-

1. Cameron, C. S. The truth about cancer. Englewood Cliffs, N. J., Prentice-Hall, Inc., 1956.

tochemical and other methods were introduced, dentists and their associates not only tested them but they contributed to the total advancement in the field.[2-10] The precancerous lesion is of especial interest to the dentist.[11] Much has been learned of precancerous lesions and much remains to be learned. From experience it is known that only a small percentage of white spots in the mouth develop into carcinoma. The dentists are learning to differentiate the benign from the potentially malignant and to recognize that if certain changes are seen, microscopically, in the cells of a white oral lesion, it is more dangerous than are others without these changes. As better tools are used to cope with the problems, the dentists may learn to make simple intraoral tests that may prevent untimely death on one hand and unnecessary anguish on the other. Such studies are already under way in several laboratories.[2, 3, 11, 12]

The careful and often, within a given lifetime, apparently fruitless search for causes must be continued. Certain circumstances or factors that seem to contribute to cancer etiology are known, but the cause is uncertain. Some types of cancer seem to appear more frequently in one family than in another, but in the human race the hereditary factors usually are relatively unimportant and overshadowed by other agents. Whereas retinoblastoma and intestinal polyposis show strong genetic factors, no such relationship has been established for oral tumors, although peroral and intraoral pigmentations may be suggestive of intestinal polyposis.

The retention of cell rests may be a factor in tumor growth. Along with the Wilms tumor of the kidney, the ameloblastoma of the jaw appears to be in this general class. Chronic irritation has long been recognized as a contributing factor in cancer. Certainly the mouth is especially subject to chronic irritation from rough teeth, edges of broken restorations, dentures that have outlasted their biological adaptation, and infection. Efforts were directed at placing a major blame on reactions from dissimilar metals in dental appliances,[13, 14] but this factor appears to play an extremely minor role, if indeed any at all. Although investigations have not yet established any of these chronic traumatic factors as positive causes of cancer, neither has research cleared them of charges. They must be held under suspicion and corrected if they exist in any individual mouth. Radiant energy has been indicted as a factor in carcinogenesis through circumstantial evidence such as in instances of lip cancer in sailors and farmers, and through experience with dentists who neglected to heed warnings against holding dental films in patients' mouths, as well as through experimental exposure of animals.

One of the most striking and tragic chapters in this connection is the radium watch dial story of the women who touched their radium-containing brushes to their lips and who, in most instances, subsequently died of osteogenic sarcoma.

2. Burstone, M. S. Histochemical demonstration of proteolytic activity in human neoplasms. J.Nat.Cancer Inst. 16:1149, 1956.

3. Burstone, M. S., and Folk, J. E. Histochemical demonstration of aminopeptidase. J.Histochem. & Cytochem. 4:217 May 1956.

4. Gladstone, S. A. Sponge biopsy in diagnosis of cancer of the mouth. J. Oral Surg. 9:104 April 1951.

5. Montgomery, P. W. Study of exfoliative cytology of normal human mucosa. J.D. Res. 30:12 Feb. 1951.

6. Montgomery, P. W., and Von Haam, E. Study of exfoliative cytology of oral leukoplakia. J.D.Res. 30:260 April 1951.

7. Montgomery, P. W., and Von Haam, E. Study of exfoliative cytology in patients with carcinoma of oral mucosa. J.D. Res. 30:308 June 1951.

8. Piro, J. D., and others. Gelfoam sponge biopsy in diagnosis of oral carcinoma. Oral Surg., Oral Med. & Oral Path. 7:417 April 1954.

9. Pomeranz, M. J., and Stahl, S. S. A correlative study of cytodiagnosis and biopsy. Oral Surg., Oral Med. & Oral Path. 6:1026 Aug. 1953.

10. Ronchese, F. The fluorescence of cancer under the wood light. Oral Surg., Oral Med. & Oral Path. 7:967 Sept. 1954.

11. Weisberger, D. Precancerous lesions. J.A.D.A. 54:507 April 1957.

12. Goldhaber, P. Role of saliva and other local environmental factors in oral carcinogenesis. J.A.D.A. 54:517 April 1957.

13. Lain, E. S. Lesions of oral cavity caused by physical and by physicochemical factors. Arch. Dermat. & Syph. 41:295 Feb. 1940.

14. Shriever, W., and Diamond, L. E. Electromotive forces and electric currents caused by metallic dental fillings. J.D.Res. 31:205 April 1952.

Although the dentist must be aware of the dangers of excessive radiation to his patient and himself, he must weigh the results of research on radiation effects in genetic mutations against the medical value of diagnostic roentgen ray use.

Perhaps the best advice science can give on this is that given in the report of the Committee of the National Academy of Science which evaluated the possible genetic effects of radiation. The report[15] stated that in view of the fact that the total accumulated dose of radiation is genetically important (it may lead to mutations in the human race), the dose should be kept as low as possible, and medical authorities should initiate a vigorous movement to reduce radiation exposure from roentgen rays to the lowest limit consistent with medical necessity. From the geneticist's viewpoint, radiation is dangerous during the reproductive years for they are thinking in terms of mutations, not in terms of cancer. Scientists must be cautious but they should not allow panic to cause them to abandon a most valuable technic. Roentgen rays must be used judiciously and wisely.

Hormones, which the patient manufactures himself, have been cited as carcinogens under certain circumstances. The sex hormones are suspect in certain breast, ovarian, testicular and prostatic tumors, and this suspicion is supported by experiment. Since oral tissues may show unique extra-systemic enlargement during upsets of the sex hormones, the possibility should be considered of hormonal influence in oral neoplasia.

Viruses have long been known to cause certain tumors of fowls, rabbits, and mice and warts in humans. The oral cavity is subject to virus infections, including herpes and warts, so this possible cause of oral tumors must be considered if viruses should be shown to cause human cancer. Diet has been investigated as a possible cause of cancer. There are suggestions that vitamin B complex deficiency may be related to intraoral cancer in certain individuals, such as those with Plummer-Vinson syndrome,[11] and in some remote aborigines it may be a primary cause of some types of cancer.[1] Dietary deficiencies affected the pathogenic potential of tobacco smoke in animals.[16] Some substances added to foods may be carcinogenic, such as synthetic dyes, but the Food and Drug Administration is designated to control this through testing programs. One must beware of false claims either from those using additives or those opposing them. For example, an enthusiastic, but misguided vocal group, claimed that fluorides added to water supplies increased the incidence of cancer, a claim that has been contradicted by scientific study.[17]

The possibility that coal tar products from tobacco and in foods, in the atmosphere and elsewhere, causes cancer has been entertained for almost 200 years. Experiments have shown that cancer can be produced in animals by carcinogenic agents derived from coal tars. Although oral tissues are more resistant to these carcinogens than the skin, they are not immune to cancer induced by coal tar products. Voronoff and Alexandrescu,[18] Bonne,[19] Van Prohaska, Brunschwig and Wilson,[20] Salley[21] and Chaudry[22] have

15. Committee on genetic effects of atomic radiation, National Academy of Sciences. Genetic effects of atomic radiation. Science 123:1157 June 29, 1956.

16. Kreshover, S. J. Further observations on the effect of tobacco on epithelial tissues of vitamin-deficient mice. J.D.Res. 34:798 Dec. 1955.

17. Bittner, J. J.; Armstrong, W. D., and Singer, L. Lack of effect of fluoride ingestion on mammary carcinoma development in mice (Abst.) J.D.Res. 33:648 Oct. 1954.

18. Voronoff, S., and Alexandrescu, G. Tumeurs abdominales multiples chez le rat blanc expérimentales produits par l'ingestion longtemps répetée d'un mélange à base de goudron. Neoplasms 8:129 May-June 1929.

19. Bonne, C. Ueber Geschwülste bei Teertieren. Schr.f. Krebsforsh. 25:1, 1927.

20. Van Prohaska, J.; Brunschwig, A., and Wilson, H. Oral administration of methylcholanthrene to mice. Arch. Surg. 38:328 Feb. 1939.

21. Salley, J. J. Experimental carcinogenesis in the cheek pouch of the Syrian hamster. J.D.Res. 33:253 April 1954.

22. Chaudry, A. P. Carcinogenesis in the oral mucosa. (Abst.) J.D. Res. 34:750 Oct. 1955.

observed carcinomas on the oral or cheek epithelium after application of chemical carcinogens, whereas Levy and coworkers[23-25] and Kolas,[26] were unable to induce carcinomas on the lining mucosa or lips of animals but did induce carcinomas on adjacent skin, or sarcomas in the deeper oral tissues. Standish[27] has induced neoplasms in salivary glands by implanting carcinogens. Tobacco has been subjected to more direct study by Roffo[28] who produced leukoplakias on rabbits' gingiva with tobacco smoke. Kreshover and Salley[16, 29, 30] found it difficult to induce changes in the oral mucosa of animals subjected to tobacco smoke, but did induce tissue changes by exposure to tobacco smoke. There appears to be little doubt that tobacco products may cause undesirable changes in the oral mucosa, but the exact relationship between smoking and oral cancer has not been established definitely. Each individual must decide whether the risks of smoking are worth the pleasure derived. In the meantime, science must continue to search for the factor, or factors, in tobacco smoke which can be held responsible for carcinogenesis and find ways of eliminating such factors.

Along this same general line it should be mentioned that some acrylic resins are carcinogenic and, although these are not the types used in the fabrication of dentures, all acrylic resins used in dentistry should be evaluated thoroughly for their carcinogenic potential. Robinson, Laskin, and Weinmann[31] have investigated the effect on cells of implanted acrylic resin. The relative effects of acrylic resin, metals and vulcanite on the cells lining the oral cavity should be known, and the variation of resistance to carcinogens demonstrated by oral mucosa and skin.

Because the mucosa of the oral cavity seems to be more resistant to experimental inducement of carcinoma than the skin, the possibility of the saliva protecting the mouth has been studied. Since certain studies indicate that smegma may aid carcinogenesis, this possible role of saliva as an anticarcinogen is not unlikely. Kolas[26] found only a slightly longer interval between the appearance of skin tumors on saliva-treated skin when compared with untreated skin. Goldhaber[12] has observed oral neoplasms induced in oral tissues of desalivated mice but not in controls. The function of saliva and the relative susceptibility of the oral mucosa is a fertile area for investigation.

Goldhaber[12] used fluorescence to investigate the resistance of the oral mucosa to penetration by substances on its surface. These studies strongly suggest that the oral mucosa may be much more resistant than the surface epithelium to carcinogens.

CONTRIBUTION OF RESEARCH

As the result of research, the treatment of cancer is breaking through its limited barriers. Developments in the field of atomic energy have produced radioactive substances that may be injected as radioactive iodine, implanted in nylon threads at strategic points as radioactive gold and cobalt, or used as sources of radiation from outside the body. Chemistry has

23. Levy, B. M. Effect of a chemical carcinogen (20-methylcholanthrene) on the oral tissues. (Abst.) Oral Surg., Oral Med. & Oral Path. 1:582 March 1948.

24. Levy, B. M.; Gorlin, R., and Gottsegen, R. A histologic study of the reaction of skin and mucous membrane to single topical application of the carcinogen 9-10 dimethyl-1,2 Benzanthracene. (Abst.) J.D. Res. 29:678 Oct. 1950.

25. Levy, B., and Ring, J. R. Experimental production of jaw tumors in hamsters. Oral Surg., Oral Med. & Oral Path. 3:262 Feb. 1950.

26. Kolas, S. Investigation of normal human saliva for possible anticarcinogenic action and chemical carcinogenesis in mucous membranes. Oral Surg., Oral Med. & Oral Path. 8:1192 Nov. 1955.

27. Standish, S. M. Early cytologic changes in experimentally induced tumors of rat submaxillary salivary glands. (Abst.) J.D.Res. 34:729 Oct. 1955.

28. Roffo, A. H. Leucoplasie expérimentale produite par le tabac. Rev. Sudam. med. et.chir. 1:321 April 1930.

29. Kreshover, S. J. Effect of tobacco in epithelial tissues of mice. J.A.D.A. 45:528 Nov. 1952.

30. Kreshover, S. J., and Salley, J. J. Predisposing factors in oral cancer. J.A.D.A. 54:509 April 1957.

31. Robinson, I. B.; Laskin, D. M., and Weinmann, J. P. Experimental production of sarcomas by methylmethacrylate implants (Abst.) J.D.Res. 34:721 Oct. 1955.

offered anticarcinogens such as antifolic acid drugs which are already increasing the life span of leukemia victims. Chemotherapy for cancer has joined, supplemented, and augmented surgery and radiation. Already more is known than is generally being used to help cure cancer.

Research in the cancer field has contributed to diagnosis, prevention and control of this killer. Further exploration and development offer the hope that cancer may be controlled completely. Clinicians should not be discouraged because much of the research under way may seem to bring forth useless knowledge. Basic knowledge is not useless but, as different levels of scientists refine it from the raw material, it emerges to be used in the form of applicable facts, appliances, agents, and technics to make better and happier lives.

Faith in Humanity • I enjoy life because I am endlessly interested in people and their growth. My interest leads me continually to widen my knowledge of people, and this in turn compels me to believe that the normal human heart is born good. That is, it is born sensitive and feeling, eager to be approved and to approve, hungry for simple happiness and the chance to live. It neither wishes to be killed nor to kill. If through circumstances it is overcome by evil, it never becomes entirely evil. There remain in it elements of good, however recessive, which continue to hold the possibility of restoration.

I believe in human beings but my faith is without sentimentality. I know that in the environment of uncertainty, fear and hunger, the human being is dwarfed and shaped without his being aware of it, just as the plant struggling under a stone does not know its own condition. Only when the stone is removed can it spring up freely into the light. But the power to spring up is inherent, and only death puts an end to it.

I feel no need for any other faith than my faith in human beings. Like Confucius, I am so absorbed in the wonder of earth and the life upon it that I cannot think of heaven and the angels. I have enough for this life. If there is no other life, then this one has been enough to make it worth being born, myself a human being.

With so profound a faith in the human heart and its power to grow toward the light, I find here reason and cause enough for hope and confidence in the future of mankind. The common sense of people will surely prove to them someday that mutual support and cooperation are only sensible for the security and happiness of all.

Such faith keeps me continually ready and purposeful with energy to do what one person can toward shaping the environment in which the human being can grow with freedom. This environment, I believe, is based on the necessity for security and friendship.

The world contains food supplies sufficient for the entire earth population. Our knowledge of medical science is already sufficient to improve the health of the whole human race. Our resources in education, if administered on a world scale, can lift the intelligence of the race. All that remains is to discover how to administer, on a world scale, the benefits which some of us already have. In other words, to return to my simile, the stone must be rolled away.

This, too, can be done, as a sufficient number of human beings come to have faith in themselves and in each other. Not all will have such faith at the same moment, but there is a growing number who have this faith. Half a century ago, no one had thought of world food, world health, world education. Many are thinking today of these things. In the midst of possible world war, of wholesale destruction, the problem is whether there are enough people who now believe and whether there is time enough left for the wise to act. It is a contest between ignorance and death, or wisdom and life. My faith in humanity stands firm.—*Pearl S. Buck, Roll Away the Stone.*

Cases and Comments

COMPLETION OF ALL-ACRYLIC RESIN BRIDGE IN TWO SITTINGS

By A. H. Tamarin, D.D.S., Chicago.

An all-acrylic resin bridge when properly constructed has strength and durability and equals in esthetics an all-porcelain bridge baked on a platinum and iridium bar. The acrylic resin bridge is not difficult to construct, but skill and care are required to assure a successful product. The abutment teeth for the metallic copings are prepared under a local anesthetic during the first sitting. After the necessary impressions are taken, the entire bridge can be completed and ready for cementation in the patient's mouth at the second sitting. The procedure is as follows:

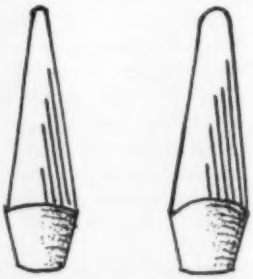


Fig. 1 • The abutment teeth are prepared for the reception of the gold copings. Parallelism must be established. Tube impressions are taken of the prepared teeth, and stone or plaster models are made.

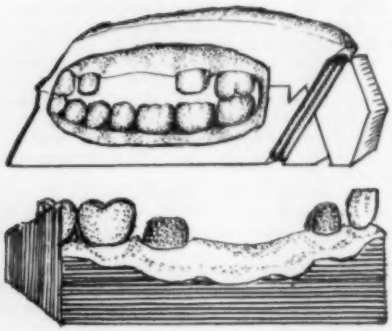


Fig. 2 • An alginate or a colloid impression is taken of the prepared teeth and the adjacent teeth, and two models are constructed. One model should be of stone or plaster, the other of investment compound. A wax bite and a separate wax impression of the opposing teeth are taken. A plaster model of the teeth is articulated with the plaster or stone model of the opposing teeth.

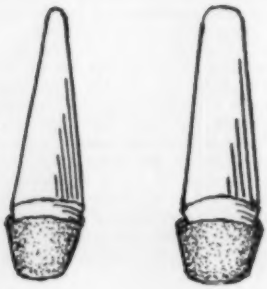


Fig. 3 • Adaptable and removable wax copings for the prepared individual teeth are obtained by saturating the plaster models of these teeth with water, dipping the prepared parts into molten wax and withdrawing them instantly. This process forms a smooth, homogeneous layer of wax. These layers are then chilled and trimmed to conform to the gingival borders.

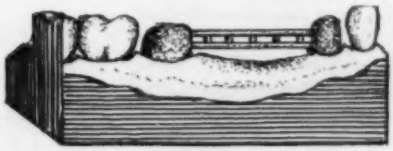
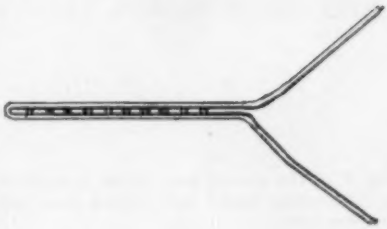


Fig. 4 • The wax copings are placed in position on the prepared teeth of the investment compound model and are sealed around the gingival edge with a wax spatula. A wax wire of 1 to 1.5 mm. in diameter is bent into two layers and united at intervals with a wax spatula to form spaces 2 to 3 mm. in length (Fig. 4, below). The wax rod is cut to the proper size and is united with the wax copings on the investment compound model.



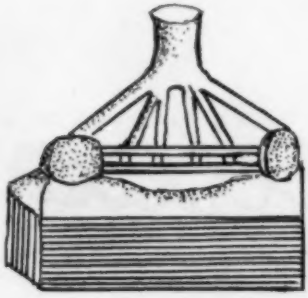


Fig. 5 • Wax sprues are adapted to the wax copings as well as to the wax rod. These wax sprues are to be united into one common sprue. The wax skeleton is invested with the investment compound model and cast.

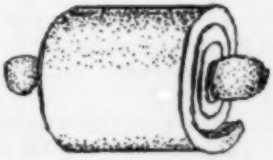


Fig. 6 • The metallic skeleton is placed on the stone or plaster model for adjustment and is covered with opaque material. This procedure prevents the metallic luster from reflecting through the acrylic resin after processing. The metallic skeleton is invested with base plate wax.

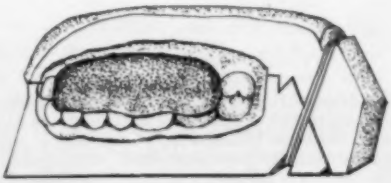


Fig. 7 • The wax invested metallic skeleton is positioned on the stone or plaster model and articulated with the opposing model.

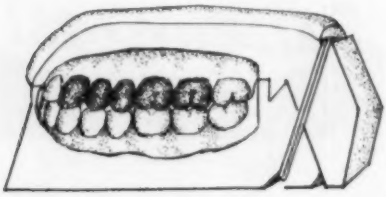


Fig. 8 • The teeth are carved from the same wax bite on the stone model.

Fig. 9 • The carved wax bridge is removed from the stone model and invested in a flask and processed.

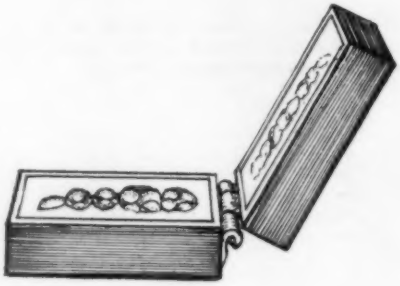


Fig. 10 • The bridge is removed from the flask and polished. It is now ready for cementation.

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The Ideal Bibliography • While the number of publications relative to any subject is likely to be great and to increase continually, the number of truly important publications is generally small. An ideal bibliography is one which is large enough to include all that is good, yet too small to include anything which is mediocre. *George Sarton, Introduction to the History of Science.*

APRIL 1957

LON W. MORREY, D.D.S., EDITOR
VOLUME 54 • NUMBER 4
Published by the American Dental Association
222 East Superior Street • Chicago 11, Illinois

THE Journal OF THE AMERICAN DENTAL ASSOCIATION

Editorials

All dentists serve in mouth cancer patrol

Unless science performs a sudden miracle, 14,700 of the 89,000 dentists now practicing in the United States are destined to die of cancer. By the same measure, 27,500,000 of America's one hundred seventy million population will die of the same disease. Mouth cancer, it is estimated, will cause the death of about 520 of today's dentists and about 612,000 of today's total population. These predictions are based on data published by the National Office of Vital Statistics.[1] That same source also reports that of the 673,831 deaths occurring among white men 25 years of age and older in the United States, 111,009, or about 16.5 per cent in 1954, were from malignant neoplasms including 3,883 from cancer of the buccal cavity and pharynx. The American Cancer Society[2] indicates that some two hundred and fifty thousand Americans in 1955 died of cancer.

These figures can be reduced—barring the miracle sought by all cancer researchers—only through keener observation and quicker action by every member of the healing professions. Certainly sterner cancer preventive and prophylactic measures must be taken by every practicing dentist if any headway is to be made in reducing deaths from the nation's second greatest killer.

Authorities are confident that the present cancer mortality rate can be reduced one third to one half if early symptoms are given adequate medical or dental attention. The American Cancer Society[2] estimates that 80,000 cancer patients who died in 1955 might have been saved if their condition had been diagnosed earlier and properly treated. Authorities also advise that the percentage of potential cures is higher in the mouth, lip and skin than elsewhere. Eighty per cent of deaths caused by cancer of the mouth, it is estimated, could be averted by early diagnosis.

This observation by leading cancer authorities places a heavy responsibility on the general dental practitioner, because in most instances the general practitioner sees the patient first. In every instance of mouth cancer someone points the finger at the patient's dentist. "Why didn't he detect the precancerous lesion in time?"

The Cancer Bulletin[3]—that small but excellent publication devoted to the dissemination of cancer facts—points such a finger:

> It can be a big day for a dentist, when a person with a mouth cancer enters his office. On that day, if the dentist is suspicious of any chronic illness and abscesses, of any nonhealing sores and unusual swellings, if he regards all of these abnormal features as malignant until they are proven otherwise . . . on that day a dentist might save a life. . . . Sad to report, in many cases in which the dentist is consulted first, that hard-working individual fails to recognize cancer. Study of a series of 157 patients who had seen a dentist first revealed that 62 per cent of the cancers went unrecognized. The dentist administered . . . other types of local therapy. The patient was reassured by the dentist's endeavors, and embarked on a second program of delay that consumed several more precious months. To many of the patients, of course, this was disastrous.

Statistically accurate or inaccurate, debatable or nondebatable, the report is cited here as it presents a challenge to every practicing dentist. Even though much progress has been made in cancer research and even though many great minds are spending years in search of more data on the subject and despite the vigilance of most dentists, oral cancer is on the increase. No dentist can afford not to employ his full knowledge; not to apply his complete diagnostic skill; not to use the best of judgment in making an examination. On the manner in which these services are performed may hang the life of the patient.

1. Vital statistics of the United States, 1954, vol. 2. National Office of Vital Statistics, Public Health Service, U. S. Department of Health, Education, and Welfare.
2. The American Cancer Society feature service, vol. 11, no. 1, 1956.
3. Cancer Bul. 1:99 Nov.-Dec. 1949.

National Children's Dental Health Week

The 1957 National Children's Dental Health Week, February 3-9, once again served to center the nation's attention on preventive dentistry and the continuous program of the American Dental Association to improve the dental health of American children. The success of this annual project (see the report of the Bureau of Dental Health Education on page 560 of this issue) has grown so great that it has attracted the attention and active support of other national groups.

The dental profession gratefully acknowledges the assistance and cooperation of those groups and of the many individual agencies and organizations which contributed to the effectiveness of this year's observance. Special thanks are due the National Dairy Council, the International Apple Association, and their local counterparts, for providing educational material of a high order.

With the continuous cooperation of these organizations, the 1958 observance of National Children's Dental Health Week will be even more successful than this year's, if state and local chairmen and committees are appointed soon, and if initial plans are made on the basis of the lessons learned from the 1957 program.

World Health Day: food and health

On April 7 the United States joins with other nations in the 1957 observance of World Health Day. The occasion and its theme, "Food and Health," will be utilized by nutritional experts of all countries to emphasize the facts that lack of food and the eating of the wrong kinds of foods are emerging as the greatest causes of disease in poor, underdeveloped areas, whereas in rich countries overeating and obesity contribute to the toll exacted by the degenerative diseases.

Although much remains unknown regarding the relation of nutrition to dental health, the relation between food and general health is fairly clear. Unfortunately, food faddists have beclouded the discussion of food and health with a great deal of nonsense. Many unqualified persons assume the pose of authority and misuse and misinterpret the limited known facts about nutrition.

THE JOURNAL'S contribution to World Health Day is to plead for moderation and reasonableness in making and accepting claims for specific items of food and specific forms of diet as they relate to dental health.

It is only in the field of dental caries control that diet therapy is based on sound evidence. Dentistry is aware of the role played by carbohydrates in caries etiology, and that the form of the carbohydrate and the materials with which it is mixed are important. A common lay misconception related to nutrition and teeth is that caries can be reduced or eliminated by feeding diets rich in calcium after the teeth have formed. A good diet in itself will not reduce or prevent caries. Some of the mouths with the least carious teeth are found in the mouths of persons suffering from severe malnutrition.

There are no data which indicate that the results of periodontic and orthodontic treatment are influenced by any specific diet therapy.[1]

The American Dental Association's Council on Dental Therapeutics,[2] in its discussion of nutritional factors in dental disease, states:

> It is suggested that dietary management receive secondary emphasis in periodontal treatment unless there is definite evidence of nutritional inadequacy. It would appear desirable also for the patient to realize that treatment in the dental office and the home procedures for the maintenance of oral hygiene are of first importance, and improvement in nutritional status can only supplement these measures. There is no conclusive evidence that the addition of vitamins to an already adequate diet is of value in the prevention or treatment of disease.

The gratifying increase in the amount of nutritional research now being undertaken by dental investigators promises a fruitful future for all departments of dentistry, particularly those concerned with the prevention and control of dental diseases. A comparison of the state of this nation's dental health with that of peoples in other and less prosperous countries indicates that America still has much to learn regarding the relation of diet and nutrition to the health of the mouth. The World Health Organization provides dentistry and its researchers with a new, broad avenue leading to wider fields of knowledge in nutrition. American dentistry welcomes the opportunity of joining with the World Health Organization in the observance of World Health Day.

1. Jay, Philip. What the dental student should be taught in nutrition. J.D.Educ. 20:301 Nov. 1956.
2. Council on Dental Therapeutics. Accepted dental remedies, ed. 22. Chicago, American Dental Association, 1957, p. 156.

International Correspondence

NEWS FROM GREAT BRITAIN

In 1948, The Rt. Hon. Viscount Nuffield made a gift of £250,000 to the Royal College of Surgeons of England for the erection of a residential college to be known as the Nuffield College of Surgical Sciences, and a further grant of £175,000 for the same purpose was made by the King Edward's Hospital Fund for London in 1954.

While the Nuffield College of Surgical Sciences was being built, a smaller residential college was formed by adapting two existing houses on the west side of the Royal College of Surgeons, and this, opened officially by Viscount Nuffield on June 23, 1949, housed 24 postgraduate students.

The Nuffield College of Surgical Sciences was completed by the end of 1956, and the first residents moved in on the first of February, 1957. The new school can accommodate 80 postgraduate students, as well as provide accommodation for visiting lecturers and professors.

Each of the single bedrooms is furnished as a study-bedroom, and there are available in the building lounges, a billiards room and squash court.

The Nuffield College of Surgical Sciences will be officially opened by Lt. Gen. The Lord Freyberg, V.C., on Friday, April 5, and Viscount Nuffield himself will be present.

NATIONAL HEALTH SERVICE

Sir John Charles, chief medical officer of the Ministry of Health, in his annual review on the state of the public health (Command No. 16, H.M.S.O. price 9s.), commented on dental health as follows:

"So widespread has dental disease become in this country that it is rare indeed to find a five year old child or an 18 year old adolescent completely free of dental decay. The adult who has not lost one of his teeth is equally rare. It is common to find school entrants with an average of more than five teeth decayed, missing or filled, and it has been calculated that one adult in five is toothless."

Hope for the future lies in the dental care given to children, the report states, and there is nothing known "which will relieve the parent, child or adult of that daily personal care which is at present essential to prevent dental disease."

Two thirds of the child population from three to 15 years of age do not have dental care in any one year, the medical officer points out. Because the number of dentists is still too low to provide for current needs, Sir John Charles believes priority should be given to women in their first pregnancy.

In the Kent County Council annual report for 1955, Mr. F. J. Saunders, principal dental officer, reports that the county has some 227,500 children on the school roll and has 25 full-time and 14 part-time dental officers on the staff. This is well below the estimated need. Dr. Elliot, the principal school medical officer, looks to the employment of ancillaries to effect some improvement, a view which is endorsed by quite a number of responsible school medical officers up and down the country.

Over 84,000 children (37 per cent) had a routine inspection at school. Of 57,000 found to be in need of treatment, 54,000 were referred for urgent attention. In addition, over 13,000 special cases were referred for relief of pain, for advice or for orthodontic treatment. Of 39,000 children actually treated, 35,000 completed treatment. With certain area variations, the over-all allocation to each officer was 7,515, compared with 6,836 in 1954.

In the Staffordshire County Council annual report for 1955, Mr. Winter, the principal dental officer, reports a startling increase in dental caries since the end of the war and the abolition of the control of sweets. Dr. Ramage, the principal school medical officer, comments that this increase is not now a temporary phenomenon, and only preventive measures can reduce the demands on a severely contracted staff. As illustrative of the deterioration in the dental condition of the five year old age group, 1947 saw 22.3 per cent of these children with four or more decayed teeth. In 1955, the figure had risen to 51.9 per cent.

PARLIAMENT

In the House of Commons on December 21, 1956, a debate was initiated on the recruitment of dentists with particular reference to the Report of the McNair Committee. This debate is reported in the *British Dental Journal* of January 15, 1957, page 78. Many aspects of the problem were debated, among them the need for propaganda, the discontent of the

profession with the Health Service and the need for new schools. In the debate the parliamentary secretary to the Ministry of Health, Miss P. Hornsby Smith, remarked on reduction of earnings in late life and group practice.

"A feature of the dental services in this country was the preponderance of single-handed practices. This resulted in very high overhead costs, a lack of opportunity for the dentist to concentrate on the work at which he was most apt or which he found most congenial. The skill and experience of the older dentist was often not adequately used, and thus, from the point of view of earning capacity, failed to compensate for his growing inability to work for as long and as speedily as his younger colleagues. It was this structure of the profession which gave rise more than any other factor to the peculiar pattern of earnings, which dropped considerably from middle age onwards.

"No one would deny that the skill and experience which came from a lifetime of practice should be recognised in the remuneration of a dentist if in fact he was applying that skill and experience and not spending his time on the more routine type of case which could be dealt with as ably and more speedily by his junior. Outside the hospitals and clinics the answer seemed to lie in group practice.

"One could envisage the dental team of the future as consisting of one member whose special interest lay in preventive dentistry and the care of children, another whose forte was conservative technique, another who had specialised in oral surgery, and another who had made the provision of dentures his specialty. All of these would work under the leadership of the senior member of the firm, a man ripe in experience and diagnostic ability.

"Such a team, backed up by the skilled services of a dental hygienist and a dental technician, would go far to satisfy the professional aspirations of the young dental men and women of the future. The time had perhaps come for the profession to give very serious thought to the advantages which would lie in the introduction of group practices of that kind."

ITEMS OF INTEREST

In a written reply on December 17 the Minister of Health stated there were about 11,200 dentists in practice in England and Wales. Of the 9,800 who provide general dental service as part of the National Health Service about 3,800 are aged 55 or more.

A fine motor car tour has been organized by Dennis Reid of Torquay for those who wish to travel in their own cars to Rome for the F.D.I. Twelfth International Dental Congress September 7-14. An itinerary with two alternatives has been drawn up. A meal and accommodation are provided at the end of each day's drive. The route between night stops is not given unless a route is requested, so that there will not be any regimentation, and those who wish to make a variation from the shortest route will be able to do so.

It is anticipated that well over a hundred cars will take part in this tour, and Mr. Reid is to be congratulated on organizing what is probably a unique tour in the history of international dentistry.

Full details of Fulbright travel grants for 1957-58 are announced by the United States Educational Commission in the United Kingdom. Under the Fulbright program, travel grants are available to citizens of the United Kingdom and colonies to go to America for an academic or educational purpose, such as study, research or lecturing. All awards are competitive. Recommendations are made by the Commission, but the final decisions rest with the Board of Foreign Scholarships in Washington.

The American Dental Society of London held its usual monthly dinner and meeting in February at the Royal College of Surgeons. A paper was given by Dr. Frank Ingram on dental roentgenology.

Gerald H. Leatherman,
D.M.D., F.D.S., R.C.S., F.A.C.D.

Association Affairs

A.D.A.-N.A.D.L. COMMITTEES WORK ON CERTIFICATION PLAN

Two working committees each composed of three representatives from the American Dental Association and three from the National Association of Dental Laboratories have begun discussions of the technical aspects of a program that might be developed for the certification of dental laboratory technicians. The committees were set up at an N.A.D.L.-A.D.A. conference in Washington, D. C., March 9 and are to report their work to another joint conference April 13 in Chicago. The results of the conferences will be submitted to the House of Delegates of both organizations.

At the Washington, D. C., conference, the representatives of the two associations agreed that the educational standards of the certification program are to be established by the American Dental Association "with the full consultation and cooperation of the National Association of Dental Laboratories." Pending completion of the work on certification, formal implementation of the N.A.D.L.'s certification program will be deferred.

A program for accreditation of laboratories also is being studied at the series of conferences, but the certification of laboratory technicians will receive priority consideration since the design of that program may affect the further development of an accreditation plan.

The first working committee, which met March 24, was assigned the task of recommending educational standards of certification. The second committee, which will meet in Detroit April 6, will discuss administrative procedures for a certifying agency.

Appointed to the working committee on education standards were Willard C. Fleming, Maynard K. Hine and Carl A. Laughlin for the American Dental Association, and Mr. George Klein, Mr. Don Neuenschwander and Mr. Maurice Nicole for the N.A.D.L.

Serving on the committee on administrative aspects are Philip E. Blackerby, Jr., Walter E. Dundon and Paul H. Jeserich for the American Dental Association; Mr. Ralph B. Rothstein, Mr. G. Paul Stough and Mr. Victor Van Fleet for the N.A.D.L.

Mr. Nathan Cooper, N.A.D.L. president, presided at the March 9 conference. A joint statement issued at the close of the meeting follows:

> Representatives of the two associations readily arrived at agreement on the importance of developing a certification program to identify, recognize and recruit dental laboratory technicians. The educational standards for such a certification program are to be established by the American Dental Association with the full consultation and cooperation of the National Association of Dental Laboratories. In designing such a program it was agreed that consideration should be given to establishing a general knowledge certificate for the qualified dental laboratory technician, with such divisional certificates as would subsequently be agreed upon as the result of further technical discussions between the two associations.
>
> In establishing the certification program, representatives of the two associations decided that consideration should be given to designating "charter members" and to utilizing a system of "waivers" which would recognize dental laboratory technicians essential to certification procedures without formal examination requirements. The details of the charter and waiver provisions will be developed in further discussions between the two associations.
>
> Representatives of the two associations agreed to establish two working parties in

order to carry on the technical discussions indicated in the areas of agreement.

The first of these working parties, composed of three representatives from each association, will develop a joint recommendation on the educational aspects of the certification program while the second working party will devote itself to the preparation of a joint recommendation on the administrative aspects of the certification program. These recommendations will be presented at the next conference of the two associations to be held on April 13 in Chicago. It was also agreed that the working parties and the next conference will give priority consideration to the development of the certification program for dental laboratory technicians since its design may be directly related to the further development of the accreditation program for the dental laboratories.

In view of the effective progress made at the conference toward mutually acceptable solutions, it was announced that formal implementation of the National Association of Dental Laboratories' certification program would be deferred until the two associations had completed their work on the joint program.

NIDR BUILDING NEEDED NOW, HARRY LYONS TESTIFIES

A building to house the National Institute of Dental Research is critically needed now, Harry Lyons, Association president, told a House subcommittee February 28. He urged the Congressmen to include in the proposed budget for the Department of Health, Education and Welfare, a sum of $3,700,000 for construction of the building and urged them also to increase by one million dollars the proposed appropriation for dental health activities of the U. S. Public Health Service. Half the increase was recommended for the research project grants program of USPHS (for research carried out in schools and other research centers), and half for the program which awards funds to schools for the training of dental researchers.

The proposed fiscal 1958 HEW budget contains $6,430,000 for the dental health activities of the USPHS, of which $2,825,000 is for extramural research projects and $500,000 for the training grants program. The research projects appropriation is an increase of $225,000 over the appropriation for fiscal 1957; the figure for the training grants program is the same as last year.

The proposed budget contains no appropriation for construction of the NIDR building in spite of the fact that four million dollars was authorized only last year by Congress and that funds have already been spent to draw up plans.

NIDR Building • In support of his request for an appropriation for the building, Dr. Lyons pointed out to the House appropriations subcommittee that Congress itself had recognized the need for the building. He quoted from a unanimous report of last year's Senate Committee on Labor and Public Welfare that "the lack of proper facilities for the Dental Institute's program poses a serious threat to this Nation's progress toward the effective control and prevention of dental disease." Postponement of construction when building costs are rising and funds have been spent for the drawing of plans would be "wasteful" that committee said.

Dr. Lyons told the committee members that the Institutes of Health have said that the minimum amount of space needed by a researcher to work efficiently is 150 square feet, yet present space available to dental researchers at the NIDR is 125 feet. Additionally, Dr. Lyons stated, animal facilities are inadequate, and there is no area for a library or conference room.

Again he quoted the Senate committee report. "They [witnesses] have convinced the committee that the scientists now working at the Dental Institute are so crowded that effective work is difficult and expansion almost impossible. Moreover, the services of men of outstanding ability are not being utilized to the full, inasmuch as there is insufficient space to house the number of research workers who, if they could be assigned to assist

chief investigators, would multiply the efficiency and output of the latter."

Extramural Programs • The Association president told the committee that the funds appropriated by Congress to date for the extramural research program of the NIDR will be completely exhausted before the end of the current fiscal year.

As the proposed 1958 appropriation for research projects is not much larger than that of 1957, the funds will be needed to continue projects under way, and little will be left for the new ones, he said.

Additionally, an increase is needed for training grants, Dr. Lyons asserted. Research training programs in 16 schools and other research centers will be supported from the current appropriation, but 23 schools have asked for grants, and seven more intend to apply. "But unless Congress provides additional funds for this very important program, there will be few, if any, new training centers established at the dental schools and other dental research institutions during fiscal 1958," he stated.

ASSOCIATION PROTESTS BILL FOR ARMY TO AWARD DEGREES

A bill being considered by the House of Representatives Committee on Armed Services has been protested by the American Dental Association. The bill, H.R. 3516, would authorize the Walter Reed Army Institute of Research to award Masters' and Doctors' degrees in the fields of medicine, dentistry and related sciences.

In a March 19 letter, Bernard C. Conway, secretary of the American Dental Association's Council on Legislation, advised committee chairman Carl Vinson of the policy adopted by the Association's House of Delegates in 1953. A resolution passed at that time states that "the granting of academic degrees at the graduate level of master of science or doctor of science should continue to be limited to recognized universities or other academic institutions."

NAME DELEGATES TO ROME CONGRESS, F.D.I. ASSEMBLY

The full list of delegates of the American Dental Association to the 45th general assembly of the Fédération Dentaire Internationale and Association representatives to the Twelfth International Dental Congress have been announced by the Board of Trustees. Rome will be the site of both events. The Twelfth Congress will be held September 7-14, immediately after the general assembly.

Harry Lyons, Association president, will serve as chairman of the official delegation to the F.D.I. general assembly. Other members of the delegation are:

LeRoy M. Ennis of Philadelphia, a former Association president and dental consultant to the Egyptian government; Harold Hillenbrand, Association secretary; Obed H. Moen of Watertown, Wis., U. S. treasurer for the F.D.I., and Oren A. Oliver of Nashville, Tenn., a former Association and F.D.I. president.

Alternates announced by the board are: Leslie M. FitzGerald of Dubuque, Iowa, former Association president; Howard A. Higgins of Spartanburg, S. C., Fifth District Trustee; Earl G. Jones, Seventh District Trustee; John W. Knutson of Washington, D. C., third vice-president, and George C. Paffenbarger, also of Washington, senior research associate at the American Dental Association's Research Division, National Bureau of Standards.

Observers will be William N. Hodgkin of Warrenton, Va., a past chairman of the Association's Council on Dental Education, and Charles I. Taggart of Burlington, Vt., former First District Trustee.

Association delegates to the Twelfth International Dental Congress will be: Frank O. Alford of Charlotte, N. C.; Paul J. Aufderheide of Cleveland; Luther H. Butler of Greensboro, N. C.; Rolla C. Calkin of Guthrie, Okla.; Martin Entine of Philadelphia; Bernard C. Friedman of Newport, R. I.; P. Belton Hair of Spartanburg, S. C., and Magnus C. Hansen of Racine, Wis.

Additional delegates are: William M. Jarrett of Charleston, W. Va.; E. Jeff Justis of

Memphis, Tenn.; Noel Kahn of Claremore, Okla.; J. D. Kelly of LaCrosse, Wis.; Kermit Knudtzon of Chapel Hill, N. C.; Arthur F. Lindquist of Kansas City, Mo.; Lawrence Ludwigsen of San Francisco, and Dallas R. McCauley of Beverly Hills, Calif.

Also Earl Allen Nelson of Minneapolis; S. A. Schmid of Cincinnati; Carlos Schott of Cincinnati; G. B. Traylor of Norfolk, Va.; Milton Walls of Saint Paul, Minn.; John J. White of Bakersfield, Calif., and Harry Willits, of Reading, Pa.

Alternate delegates are: Frank A. Barz of Los Angeles; N. L. Beesemyer of Beverly Hills, Calif.; Carl G. Buechele of Oakland, Calif.; Stanley F. Burson of Lodi, Calif.; C. L. Curry of Shippensburg, Pa.; Dupree Davis of Dothan, Ala., and Josse E. deWever of Jersey City.

Others are: John D. Douglass of Greenville, S. C.; Laurence W. Ford of Columbus, Ohio; Steve A. Garrett of Atlanta, Ga.; DeWitt Hall of Pittsburgh; Paul E. Jones of Farmville, N. C.; Frank F. Lamons of Atlanta, Ga.; F. E. Lytle of Cincinnati; W. Wyatt Martin of Pulaski, Tenn.; E. L. McNally of Springdale, Ark.; Harvey Payne, Sr., of Atlanta, Ga.; Robert F. Sullivan of Savannah, Ga.; E. Boyd Thompson of Beverly Hills, Calif.; Claude S. Williams of Hattiesburg, Miss., and Glenn Worstell of Pittsburgh.

$124,493.57 CONTRIBUTED TO RELIEF FUND IN MID-MARCH

Contributions to the Golden Anniversary Relief Fund Drive reached $124,493.57 March 18. The total was a new high for the Fund. As of March 12, the last date for which a breakdown was available, only seven societies and four federal dental services had not reached or surpassed their quota.

SOCIETIES REMINDED OF FILM ON HAZARDS OF RADIOLOGY

The American Dental Association Council on Dental Research has reminded dental societies of the availability of the Association's color film "Hazards of Dental Radiology." In a letter sent to the societies in mid-February, H. Trendley Dean, Council secretary, noted the increased interest of the public and the profession in radiation. He pointed to the importance of the profession's being fully informed of the latest knowledge in the use of the roentgen ray and suggested the showing of the film at society annual sessions.

The film illustrates the elementary physics of dental roentgenology and by showing actual procedures in the dental office points out where hazards may exist and what recommended safety measures may be followed. The 13-minute film may be obtained from the Association's Film Library at the Central Office.

ASSOCIATION SERVED WITH FEDERAL GRAND JURY SUBPOENA

The American Dental Association has been served with a subpoena to appear before the federal grand jury of the U. S. District Court in Chicago and to produce, among other documents, all records and other data for the period starting January 1, 1954, concerning the relationship between the dental profession and dental laboratories in the Chicago area, including the counties of Cook, Lake and DuPage in Illinois and Lake County in Indiana. Similar subpoenas have been served on the Illinois State Dental Society and the Chicago Dental Society.

APRIL NATIONAL BOARDS TO TEST RECORD NUMBER

Graduates of the nation's dental schools continue to take the examinations of the Council of the National Board of Dental Examiners in increasing number. The April 1 and 2 examinations will test some 4,700 graduates, an increase of more than 600 over April of last year.

Robert I. Humphrey of Chicago, Council chairman, announces that the grades of the April examination will be accepted as partial fulfillment of licensure requirements in 30 states, Hawaii, Alaska and the three federal services.

HOSPITAL DENTAL SERVICE INSTITUTE PROGRAM OUTLINED

The preliminary program has been outlined for an institute-workshop sponsored by the American Dental Association and the American Hospital Association June 17-19. The institute will take place at the Willard Hotel in Washington, D.C. Its aim is to explore the various aspects of hospital dental service, and no recommendations of policy will be made.

First on the program will be a discussion of responsibility for patient care within the hospital, covering the governing board's responsibility, the function and organization of the hospital and the present pattern of organization of hospital dental services.

Recognition and approval programs for hospital dental departments of such organizations as the American Hospital Association, American Dental Association and the Joint Committee on Accreditation of Hospitals will be discussed on the second day as will be educational programs in dentistry carried out within hospitals. Interdepartmental relations also will be reviewed in a panel discussion.

The workshop scheduled for the last day of the conference will deal with professional problems and suggested approaches to their solution.

Registration is $45, and application may be made by writing the Institute Office of the American Hospital Association, 18 E. Division St., Chicago.

APRIL MEETING TO EXPLORE STATE-LEVEL PROGRAMS

Programs for state society councils on dental health and for state health departments will be discussed at the Eighth National Dental Health Conference April 22-24 at the Association's Central Office in Chicago. The meeting is sponsored by the American Dental Association's Council on Dental Health. Council chairman is J. H. Eshleman of Philadelphia.

Resources available to support state-level programs also will be explored by the conferees. An afternoon session will deal with the determination of costs for group purchase of dental health care and with the development of budget payment plans.

Among speakers are Joseph V. Kirby of Clayton, Mo., and Glenn R. Brooks of Rochester, Minn., members of the Council; Wesley O. Young of Boise, Idaho, state dental director; Norman F. Gerrie of Washington, D. C., assistant chief dental officer, U. S. Public Health Service; and Mr. B. Duane Moen, director of the American Dental Association's Bureau of Economic Research and Statistics.

Others are John B. Wilson of San Marino, Calif., and Mrs. Phyllis Davis of Los Angeles, both of the Los Angeles County Dental Society's budget payment plan; C. E. Rutledge of Richmond, Calif., California State Dental Association's payment plan, and Mr. Emory Gassel of Detroit, officer of the Detroit Bank.

EDITORS SAY PRESS IS FREE ON FLUORIDATION REPORTING

Charges made by antifluoridationists that the dental press has been restrained from publishing adverse information on fluoridation was flatly denied by dental editors in a resolution passed unanimously February 26. The editors, attending the Conference on Dental Journalism sponsored by the American Dental Association Council on Journalism and the American Association of Dental Editors in Chicago, passed without debate a resolution introduced by J. M. Donovan of Neenah, Wis., editor of the *Journal of the Wisconsin State Dental Society*. Thirty-four journals were represented at the meeting. The resolution reads:

Whereas, certain opponents of fluoridation of communal water have charged that dental journals are restrained from publishing any adverse information on fluorides by the Amer-

ican Dental Association and organized dentistry, and

Whereas, this statement is false and erroneous with no factual basis, and we state with all sincerity that no dental journal is restrained or has been restrained from being free to publish both sides of all controversial matters, therefore, be it

Resolved, that areas where controversies are in progress should be informed of the free press that exists in dental journalism.

APPLICATIONS INVITED FOR ANNUAL SESSION EXHIBITS

Members of the American Dental Association who wish to present scientific exhibits at the Association's 98th annual session in Miami November 4-7 may obtain applications from the Association's Council on Scientific Session at the Central Office.

Exhibits should be concerned with diagnosis, treatment or research related to dentistry or the general improvement of health. The Council is especially interested in obtaining some exhibits which employ a certain amount of demonstration, according to Charles Kurz, Council chairman.

Applications should be received no later than July 1 so that the exhibits may be listed in the preliminary program which will appear in the September issue of THE JOURNAL.

PAMPHLET ON DENTAL CAREER OFFERED FREE TO DENTISTS

By special arrangements with New York Life Insurance Company, copies of the pamphlet "Should You Be a Dentist?," written by Philip E. Blackerby, Jr., former chairman of the American Dental Association's Council on Dental Education, is being made available free of charge to state dental societies for distribution to members. The pamphlet will be helpful to dentists in their discussions with young men and women thinking about career choices. The pamphlet, which first appeared as an advertisement in several national magazines, is considered one of the best of its kind ever published. Copies are available on request to the Bureau of Public Information at the Central Office.

NEW YORK GROUP HONORS C. WILLARD CAMALIER

C. Willard Camalier, assistant secretary and a former president of the American Dental Association, was made an honorary member of the New York Academy of Dentistry March 14 at a ceremony in the Columbia University

C. Willard Camalier

Club in New York City. Only two other honorary memberships have been awarded by the Academy. Dr. Camalier is in charge of the Washington, D. C., office of the American Dental Association.

RURAL HEALTH MEETING TOLD DENTAL CARE IS ACCESSIBLE

Dental care is readily accessible to most people and the reasons they give for not visiting a dentist are poor ones, William R. Alstadt, Association president-elect, told the Twelfth Annual Conference on Rural Health March 8. The conference was sponsored by the American Medical Association.

The dental executive said that surveys show people fail to visit the dentist because of cost, accessibility of dentists

and fear. Actually, while dental fees have gone up 75 per cent since 1939, the general cost of living has gone up more than 90 per cent, he said.

Dr. Alstadt pointed out that about 60 per cent of the population lives less than five miles from a dentist and only about 3 per cent live more than 30 miles away. Good roads and the prevalence of automobiles make a visit to the dentist easy for almost everybody, he said.

The president-elect also explained the importance of diet for dental health and debunked the advertising claims of "miracle" toothpastes.

DENTAL ABSTRACTS TO CARRY THE ADDRESSES OF AUTHORS

To facilitate communication between the readers of DENTAL ABSTRACTS and the authors of the original papers abstracted, DENTAL ABSTRACTS will carry when available the addresses of authors. This new service will begin with the June 1957 issue.

In instances in which the address is not obtainable, the reader may write the editor of the journal of the original publication for such information. The addresses of the editors of all journals abstracted are published in the annual index of DENTAL ABSTRACTS. Copies of the index for 1956 may be obtained without charge from DENTAL ABSTRACTS, American Dental Association, 222 E. Superior St., Chicago 11.

Subscriptions are $6 in the United States: $7 abroad. They may be obtained from the Subscription Department.

APPOINTMENT BOOK FOR 1958 READY FOR USE NOW

The 1958 American Dental Association appointment book will be available from the Order Department at the Central Office May 15. The early publication date permits dentists to list recall appointments of patients currently being seen.

Each two page spread within the book contains space for a complete week of appointments. The page size, enlarged slightly over that of the previous edition, has been designed so that notes may be made after the patient's name. The volume contains calendars for 1957, 1958 and 1959. It lists national and major religious holidays.

The book is printed on special heavy paper stock, bound in dark green leatherette and lettered in gold. Price of the appointment book is $2.

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Federal

FUNDS EXHAUSTED AS USPHS COUNCIL OKAYS 131 PROJECTS

The National Advisory Dental Council at a March 7-9 meeting in Bethesda, Md., approved 131 grants totaling 1.4 million dollars to be awarded by the Surgeon General for research projects in dental schools and research centers. It was the largest number of grants approved at any single meeting of the Council. A total of 262 applications had been submitted for consideration at the March meeting.

The new approvals bring to 275 the number of research projects now being supported by the National Institute of Dental Research and commit all of the $2,700,000 made available for this purpose by the 84th Congress.

In addition to approving the 131 grants for specific research projects, the Council approved 9 of 13 applications for funds to support programs for the training of researchers. The $500,000 allocated for this training grants program also will be exhausted by payments on these approvals.

BASIL BIBBY IS REGENT OF NATIONAL MEDICAL LIBRARY

Basil G. Bibby of Rochester, N. Y., director of the Eastman Dental Dispensary, has been named the dentist member of the Board of Regents for the National Library of Medicine. Dr. Bibby will serve for three years. He was one of the ten men nominated by President Eisenhower for the Board of Regents.

The library was established by Congress last year and will take over the collection of the former Armed Forces Medical Library. It contains the world's largest collection of health literature.

Dr. Bibby served as consultant to the Armed Forces Medical Library from 1951 to 1954. He is a former dean of Tufts University School of Dental Medicine and holds both the D.M.D. and Ph.D. degrees.

INDICTED LABS CHALLENGE LEGALITY OF TRAYNOR ACT

Three dental laboratories, indicted for violation of the federal mail order denture act, have challenged the constitutionality of that law and several state dental practice acts. Mr. Martin S. Gerber, attorney for the three laboratories, has filed a "memoranda of law and facts" in the federal district court for the Northern District of Illinois. It is expected that the federal government's reply brief will be submitted about mid-April.

The Traynor Act, as the mail order denture law is known, makes it a crime to use the mails and instruments of interstate commerce for transporting dentures in violation of state dental practice acts.

A fourth laboratory under indictment is not represented in the suit. One laboratory has been convicted to date.

SCHOOLS NEED 77 MILLION DOLLARS, SURVEY SHOWS

The nation's dental schools need about 77 million dollars for improvement of teaching facilities, according to information contained in a staff report of the House Interstate and Foreign Commerce Committee. The report was issued in March. It covers professional education in medicine, dentistry, dental hygiene, public health and osteopathic medicine.

Information on dental education needs was obtained from questionnaires sent 45 dental schools and 34 schools of dental hygiene. The report shows that the ratio of dentists to population is declining steadily. In 1930, it was 58 to 100,000 of population; today it is estimated at 46 to 100,000. Single copies of the report may be obtained on request from the House Commerce Committee.

The Committee will soon hold hearings on an administration sponsored bill for grants to medical, dental and osteopathic schools for construction of teaching facilities.

Dental Societies

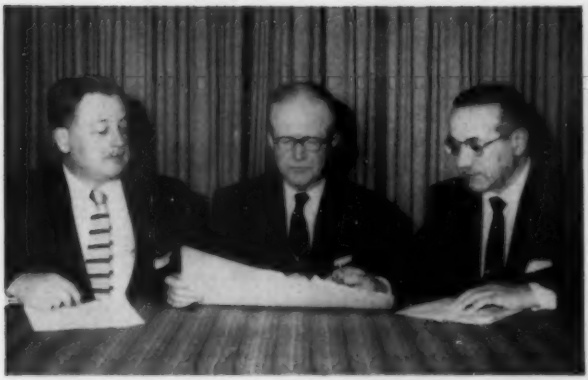
TWO STATES CLARIFY DENTIST-LAB RELATION

Tennessee and Idaho in February acted to clarify the relationship between the dental profession and the dental laboratory craft. On February 15 Governor Frank Clement of Tennessee signed a revised state dental practice act which stresses the adjunctive relation of the craft to the profession, and on February 28 Idaho governor Robert E. Smylie signed an amendment to the state dental practice act that defines as the practice of dentistry all procedures in the construction of a dental appliance which require the presence or cooperation of the patient.

The Tennessee law, whose passage climaxes efforts of the Tennessee State Dental Association to obtain an improved statute, redefines the practice of dentistry, restates the authority of the board of dental examiners and provides for penalties for violators of the act. Included is a provision for a $100 to $400 fine for first offenders and at least $1,000 and a possible prison sentence of not more than two years for second offenders. Additionally, individuals who violate injunctions barring them from practicing dentistry are faced with a mandatory prison sentence of not less than one year and a fine of not less than $1,000.

The law stipulates specifically that dental laboratory technicians may construct prosthetic dental appliances only "on the prescription, direction or order" of a licensed dentist. Work orders are now required by dental practice acts in 36 states. In 27 states and the District of Columbia, the law provides for written authorization.

Governor of Tennessee Frank G. Clement signs the state's new, strengthened dental practice act. With him are (l. to r.): R. H. Hutcheson; M.D., Tennessee commissioner of health; Mr. B. B. Gullett, Tennessee State Dental Association's attorney; James J. Vaughn, Jr., chairman of its council on legislation; Oren A. Oliver, chairman, Public Health Council of Tennessee and Clemens R. Aita, secretary, State Board of Dental Examiners.



E. Carl Miller (center), president of the Cleveland Dental Society, checks over plans for the annual spring clinic meeting of the society to be held May 6-8 in Cleveland. With Dr. Miller are (left) Harold C. Miller, chairman of the professional program, and (right) Leonard H. Samartini, general chairman. The meeting will provide both a scientific and an entertainment program.

BLUE SHIELD CONTESTS NEW YORK RULING ON DENTAL FEES

Blue Shield of New York has appealed to the State Supreme Court a ruling of New York's former Attorney General Jacob K. Javits favorable to dentistry. The Attorney General had ruled that on the basis of a 1953 amendment to the state's insurance law Blue Shield companies must pay dentists for services covered by the companies' medical expense indemnity contracts. The ruling had been sought by the Dental Society of the State of New York through its committee to study Blue Shield Plan in relation to dentistry. Joseph J. Stahl of Garden City is chairman of the committee.

The 1953 amendment expanded the scope of the law's definition of medical expense indemnity to cover "dental care provided through duly licensed dentists," but six of the seven Blue Shield companies had refused payment, maintaining that the law allowed but did not require them to do so.

In his opinion, the Attorney General declared that the amendment was intended to provide "for reimbursement for such dental care services performed under a medical expense indemnity contract as are inherently within both the practice of medicine and the practice of dentistry.

"Accordingly, it is my opinion," he wrote, "that where a medical expense indemnity contract covers service of a kind recognized as common to both the medical profession and the dental profession, a subscriber is entitled to reimbursement for such service whether performed by a physician or a dentist."

USE OF PSYCHOSOMATICS IN DENTISTRY RULED LEGAL

The attorney general of Michigan has ruled that "the practice of psychosomatics in dentistry would properly be characterized as a technic in the general practice of dentistry" under the state's dental practice act. The opinion was issued at the request of the Michigan State Board of Dentistry which in turn had been requested to seek an opinion by the board of trustees of the Michigan State Dental Association.

KENTUCKY DENTISTS START CHILD HEALTH CARE PROGRAM

A program to provide emergency dental health care and dental health education to school children in all of Kentucky's 120 counties has been inaugurated by the state's dentists. The program is a joint project of the council on dental health of the Kentucky State Dental Association

and the Division of Dental Health of the Kentucky State Department of Health, reports F. W. Jordan, chairman of the association's executive committee.

Plans call for the establishment of clinics in each county; until permanent clinics are set up, local dentists' offices and the state's four mobile dental units will be used.

School children will be examined by health department personnel and will be referred to dentists for treatment. Dentists are to be paid on a fee basis by the local health department.

MINNESOTA SOCIETY DEDICATES BUILDING APRIL 1

The Minnesota State Dental Association, one of the first state dental organizations to construct its own building, has moved into its new quarters in St. Paul. The two story structure, which cost $75,000, will be dedicated formally April 1 at ceremonies held in conjunction with the annual meeting of the state association.

The building, of contemporary design, is a combination of tan Saskatchewan brick, steel, wood and glass. The second floor, used for society activities, includes the secretary's offices, a board room and editorial quarters for *North-West Dentistry*, official journal of the Minnesota, North Dakota and South Dakota state dental associations. The lower floor is used mainly by the Minnesota State Board of Dental Examiners. There is also a sizeable parking lot.

The building is located at 2236 Marshall Ave., in a residential section midway between the downtown sections of St. Paul and Minneapolis. It was financed entirely by voluntary contributions.

Iowa's governor Herschel C. Loveless signs a proclamation designating February 3-9 as Children's Dental Health Week. Looking on are Maurine Hite, dental hygienist for Des Moines schools, and Chris Lindquist, first grader. Similar scenes were enacted throughout the country as dental societies and civil groups sponsored radio and TV programs, school poster, smile and essay contests to promote the event. The American Dental Association supplied societies with more than a quarter million pieces of literature for the health week.

Guests at the banquet held during the annual meeting of the Colegio Cirujanos Dentistas de Puerto Rico in San Juan January 24-26 heard a progress report on the organization of the School of Dentistry, University of Puerto Rico. The report was made by A. Raymond Baralt, the school's dean. Seated (l. to r.) at the presidential table are: Mrs. Edith Arenas, wife of the Colegio's incoming president; Edward R. White, Fourth District Trustee; Mrs. Baralt; Manuel A. Rosso, Colegio president; Dean Baralt; Mrs. Rosso, and Jose Vincente Arenas, incoming president of the Colegio. Other guests are unidentified.

Dental Education

BAYLOR PERIODONTICS COURSE LEADS TO ADVANCED DEGREE

Two graduate programs in periodontics begin in September at Baylor University College of Dentistry in Dallas, Texas. A nine month course leads to the degree of Bachelor of Science; half the program will be devoted to advanced study in basic science and half to clinical work. The second program, 20 months in length and leading to a Master of Science degree in dentistry, incorporates the material of the B.S. program and adds a summer term for clinical experience and a nine month term of advanced study in the theory and clinical practice of periodontology.

GRADUATE STUDY SCHOLARSHIP OFFERED BY NORTHWESTERN

Three scholarships for graduate study in dental basic science are offered by Northwestern University Dental School in Chicago. The scholarships carry an annual stipend of $2,500 plus tuition costs. Appointments will be in bacteriology, pathology or physiology. Further information may be obtained from the director of dental graduate study at the school.

OHIO POST-COLLEGE ASSEMBLY TO REVIEW SCHOOL RESEARCH

A review of the research activities of the College of Dentistry of Ohio State University will be a major item on the program of the College's Thirteenth Annual Post-College Assembly in Columbus April 17 and 18. Summaries of the research programs in oral surgery, periodontics and prosthodontics will be presented by three essayists.

Additionally, essays and limited attendance clinics are planned. Essayists include Stanley D. Tylman, professor of fixed and removable partial dentures at

the College of Dentistry, University of Illinois, and Brian E. D. Cooke of the department of dental medicine, Guys Hospital, London.

Other essayists are M. L. Allison, Neal A. Harper and Oscar P. Snyder, all of Columbus.

SCHOOLS ANNOUNCE SPRING AND SUMMER COURSES

Illinois • A radiology workshop for practicing dentists will be presented by the University of Illinois College of Dentistry in Chicago April 27 and 28. The workshop, a group participation project, will concentrate on three subjects: radiation hazards, the introduction of higher energy x-ray machines into dentistry, and the new thinking needed to interpret the significance of early bone changes in relation to roentgen rays. The course will be limited to 12 dentists but will be repeated May 4 and 5 for an additional 12. The workshop is under the direction of Seymour Yale, head of the department of dental radiology at Illinois.

Northwestern • The use of drugs in dental practice will be taught May 1-3 at Northwestern University Dental School in Chicago. Legislative regulations pertaining to drug therapy will be discussed. Laboratory demonstrations are planned of representative drug actions and toxic manifestations. The faculty is Stanley Harris, Warren R. Schram and Ardelle C. Lane, Ph.D. J. Roy Doty, Ph.D., secretary of the American Dental Association's Council on Dental Therapeutics, will be guest lecturer.

Washington (Seattle) • The University of Washington School of Dentistry in Seattle announces two refresher courses for May. The washed field technic with hydroceptor in accelerated dentistry will be taught May 6 and 7. Aim of the course is to explain the use of this technic in all branches of dentistry. Participants are invited to bring their assistants to the course without extra charge. The technic will be demonstrated on patients the second day of the course. Also offered by the school is clinical occlusion May 13-17. Arne G. Lauritzen, a diplomate of the American Board of Prosthodontics, will teach. Dr. Lauritzen holds degrees from the University of Copenhagen Dental School and Northwestern University Dental School.

Additionally, the school offers a course on procedures in the use of amalgam May 24-26. The fundamentals of cavity preparation in deciduous and permanent teeth will be reviewed. Composition, physical changes in and manipulative procedures for the various amalgams will be discussed. The course includes a day and a half of clinical work.

Western Reserve • A three day course in newer concepts of periodontal therapy will be offered June 22-24 in Cleveland by Western Reserve University School of Dentistry. Henry M. Goldman, professor of periodontology in the graduate school of medicine, University of Pennsylvania, will teach. Dr. Goldman is also director of dental research at Reisman Dental Clinic. Various types of periodontal therapy, including surgical technics, will be televised from the clinic to the classroom as the procedures are being performed. Lectures and movies will supplement the telecasts.

Public Health

NEW YORK FLUORIDATION UNLIKELY THIS YEAR

An informal poll of members of New York City's Board of Estimate taken after a 14 hour public hearing March 6 indicated that fluoridation of the city's water supply was unlikely this year. The *New York Times* reported that many Board members said they were "dazed" by the mass of testimony presented by the 88 proponents and opponents of the measure and that they felt much time would be needed to evaluate the arguments. Observers also pointed out that city elections are to be held this fall, a fact that tends to postpone action on controversial issues. Mayor Wagner, who previously said he personally is in favor of fluoridation, is a candidate for re-election.

More than 600 persons crammed City Hall for the hearings and overflowed into the nearby city council chamber which had been connected by a public address system.

Among the 34 speakers for the health measure were such well-known persons as pediatrician and author Benjamin Spock, M.D., who heads the Committee to Pro-

tect Our Children's Teeth; John W. Knutson, D.D.S., assistant U. S. surgeon general and chief dental officer of the U. S. Public Health Service; W. W. Bauer, M.D., director of health education of the American Medical Association, and Leona Baumgartner, M.D., New York City's health commissioner.

The city health department had recommended fluoridation for the city in three separate reports. A task force of the American Public Health Association had recommended it also. Prior to the hearing, the Committee to Protect Our Children's Teeth had released a statement favoring fluoridation signed by 225 scientists.

Others who testified for the measure included Percy T. Phillips, American Dental Association Trustee; Howard C. Hodge, professor of pharmacology and toxicology at the University of Rochester School of Medicine and Dentistry, Mr. Harry E. Jordan, executive director of the American Water Works Association; Howard A. Rusk, M.D., chairman of the department of physical medicine and rehabilitation, New York University-Bellevue Medical Center, and Peter Marshall Murray, of the coordinating council of five county medical societies.

Chairman for the opposition was Jonathan F. Forman of Columbus, Ohio, chairman of the Medical-Dental Ad Hoc Committee on Evaluation of Fluoridation. Among those testifying against the procedure was Arthur C. Ford, New York commissioner of water supply, gas and electricity, who claimed that the benefits of fluoridation had been exaggerated and that control of the recommended proportion through the maze of New York's water system would be "formidable."

Others testifying against the procedure included George L. Waldbott of Detroit, F. B. Exner of Seattle, and Maj. Gen. Charles W. Christenberry of the New York Christian Science Committee on Publication.

Meanwhile, two additional communities announced the start of the procedure. The Massachusetts communities of Andover, population 14,535, and Wilmington, population 9,408, began fluoridation in February. As of March 1, the U. S. Public Health Service reported that 1,492 communities with a population of 31,485,409 had controlled fluoridation.

PRESIDENT TELLS NEWSMAN HE DRINKS FLUORIDATED WATER

The President of the United States drinks fluoridated water. In response to a question asked him by a reporter at a Washington, D. C., press conference March 7, the day after New York City's fluoridation hearing, President Eisenhower said he drinks tap water at home and bottled water when he travels. The nation's capital has had fluoridation for nearly five years.

The reporter informed the president that "some people in the District have quit drinking the District water because they don't approve of the fluoridation," and added, "There is a big controversy going on in New York City at the moment."

The President replied, "I know that." Then he said, "Well, I'll tell you; in the White House I drink it often, very often."

WASHINGTON COURT REJECTS ANTIFLUORIDATIONIST CLAIM

The Superior Court for Lewis County of the State of Washington on February 4 denied the attempt of antifluoridationist F. B. Exner of Seattle to collect a $1,000 reward from the Chehalis Fluoridation League. The League had offered the amount to anyone who could prove fluoridation harmful.

Dr. Exner based his claim for the award on the presence of mottled enamel on the teeth of two patients who, he testi-

fied, had consumed water containing fluorides in the amount of 1 ppm or less.

In rejecting Dr. Exner's claim, Judge John S. Langenbach relied on the testimony of Frederick S. McKay of Colorado Springs and Robert A. Downs of Denver, noted researchers, who reported to the Court that they had studied the water in the Colorado areas in which the patients had lived and had tested the well water supposedly consumed by them. The scientists testified that the fluoride content of that water was more than 1 ppm.

The Court pointed out also that Dr. Exner had admitted that he had done no laboratory work on fluoridation and that he knew nothing about the subject prior to 1949. The Court noted also that Dr. Exner had testified against the health procedure in a court case in 1952 and that the court in that case had upheld the measure. "It may be assumed, therefore," Judge Langenbach wrote, "that the trial court disbelieved the plaintiff's testimony."

"In the light of the facts . . . and testimony of the two dental doctors," the decision concluded, "the Court is forced to the conclusion . . . that the use of fluoridation in the proportion of one part per million does not produce an ill-effect upon a person."

National Defense

DENTISTS INVITED TO APRIL CIVIL DEFENSE COURSE

A course in the operation of health services in civil defense will be held April 15-19 in Atlanta, Ga., under the sponsorship of the Federal Civil Defense Administration. The course is designed to train men who can become leaders in their communities and who will train others to provide emergency health services.

Dentists, physicians and other members of the health professions who wish to attend the course may obtain application forms from Mr. Thomas H. Goodman, FCDA regional administrator, Thomasville, Ga. Course content will include discussion of hospital disaster planning, biological and chemical warfare, radiation and management of the sick and injured. There is no tuition.

ARMY SELECTS 24 STUDENTS FOR DENTAL INTERNSHIPS

Twenty-four students from 17 dental schools have been selected by the Army for internships beginning July 1, Maj. Gen. James M. Epperly, chief of the Army Dental Corps, announced last month.

All will be commissioned as first lieutenants in the Dental Corps of the Regular Army. Nine of the group previously had participated in the Army's senior dental student program. The internship is of the rotating type and is approved by the American Dental Association's Council on Dental Education.

International

"FOOD AND HEALTH" IS THEME OF 1957 WORLD HEALTH DAY

The United States is joining with other nations and private health groups in the celebration of World Health Day April 7. The yearly international event marks the anniversary of the founding of the World Health Organization, a United Nations specialized agency.

This year, "Food and Health" will provide the theme for a series of programs dealing with nutrition, food production and distribution, as well as with food protection and sanitation. The theme will be used also to recruit young Americans for careers in food and health programs.

U. S. agencies cooperating include the Department of Health, Education and Welfare; the Department of Agriculture,

and the Department of State. Kits for use in health day celebrations may be obtained from Henry Van Zile Hyde, M.D., chief, U. S. Public Health Service Division of International Health.

JAPANESE AND U. S. DENTISTS ON APRIL MEETING PROGRAM

Japanese and United States dentists will share the platform on the scientific program of the Japan Dental Association meeting April 28-30 in Tokyo. About 40 U. S. dentists are expected to present essays and clinics. William R. Alstadt, president-elect of the American Dental Association, will address the opening session of the three day meeting.

STUDY CLUB OF MEXICO PICKS CLINICIANS FOR MAY MEETING

Eight clinicians from the United States and Mexico will appear on the program of the tenth annual seminar of the Grupo de Estudios Dentales U.S.C. de Mexico to be held in Mexico City May 12-16.

The clinicians are Hermann Becks of San Francisco, president of the American Institute of Dental Medicine; Bernard Z. Rabinowitch of Los Angeles, prominent pedodontist; Alfred L. Lopez of Albuquerque, N. Mex., who will speak on amalgam restorations, and Ross E. Waltzer of Tulsa, Okla., periodontist.

Others are W. Robert Irwin of Los Angeles, faculty member of the University of Southern California; Abelardo Gutierrez Morelos, professor of oral surgery, University of Guadalajara, Mexico, and Enrique C. Aguilar, dental school of the University of Mexico. Additionally, noted Mexican psychiatrist Alfonso Leon de Garay, M.D., will be on the program. Dr. Leon de Garay will discuss the dentist's personality and the management of patients' fears.

Reservations for the meeting may be made by writing Roberto M. Ruff, president-elect, Niza No. 6, Mexico 6, D.F.

FINLAND'S ORTHODONTISTS ELECT NILS ANDERSSON

Nils Andersson has been elected chairman of the board of Odontologiska Samfundet i Finland for 1957. Other officers elected are: Rolf Schvindt, vice-chairman; Henrik Jansson, secretary; Else Helminen, paymaster; Björn Köhler, clubmaster, and Rita Lundsten-Pohjanpää, registrar. Board members are Karin Åström, Ulla Krause, Kurt Carpelan and Nils W. Salmelin.

ROBERTO REIG, EX-PRESIDENT OF URUGUAYAN SOCIETY, DIES

Roberto Reig, a past president of the Asociación Odontológica Uruguaya, has died, according to an announcement received February 11 from Asociación president Ariel de la Sierra. Dr. Reig, in addition to heading the Asociación, was a past president of the Agrupación Universitaria del Uruguay, federation of the professional organizations of the country. He was co-author, with Francisco M. Pucci, of the book *Root Canals.*

ARGENTINE ORTHODONTISTS ELECT 1957 OFFICERS

Elio A. De María was chosen president of the Sociedad Argentina de Ortodoncia at a meeting held December 14 in Buenos Aires. Chosen vice-president was Román Santini. Completing the roster of officers are: José Luis Ferrería, secretary; Alberto Bonilla, assistant secretary; Alberto Moreira Lescarret, treasurer, and Fernando Archain, assistant treasurer.

ANTONIO CALLE GUEVARA HEADS ARGENTINE DENTISTS

Antonio Calle Guevara was installed as president of the Asociación Odontológica Argentina December 14. Elected vice-president was Raúl Otaño Antier. Other officers are José Manuel Lueje, secretary;

Hernán M. Echenique, assistant secretary; Hermenegildo M. Arnejo, treasurer, and Diego R. Pérez Espinosa, assistant treasurer.

ALFRED BERGUIDO IS NEW PANAMA SOCIETY PRESIDENT

Alfred H. Berguido has been elected president of the Asociación Odontológica Panameña. The new vice-president is Pedro E. Brin. Other officers are: Aida Illueca A., secretary; Ignacio López, social secretary; Julio Ortíz, press secretary; Agustín Arango, treasurer, and Hernando Ibañez, auditor.

General

EUGENE LANDESS, VETERAN TENNESSEE DENTIST, DIES

Eugene Shofner Landess of Fayetteville, Tenn., a past president of the Tennessee State Dental Association, died in Nashville January 21. He was 78 years old.

Dr. Landess, who practiced dentistry until two days before his death, had been in practice 55 years. He was the dental associate of his brother-in-law, Robert Louis Lasater, another veteran dentist, who died last October after 73 years in practice.

Dr. Landess was a graduate of Northwestern University Dental School and an active clinician on the subject of swaged-gold and soldered three-quarter crown construction.

MICHAEL MESSORE TO DIRECT HOSPITAL DENTAL CLINIC

The board of trustees of the Rhode Island Hospital in Providence in late January announced the appointment of Michael B. Messore of Cranston, R. I., as director of the hospital's Samuels Dental Clinic for Children. He succeeds Richard E. Deutch, who resigned.

Michael Messore

Dr. Messore is chairman of the State Board of Dental Examiners. He is a member of the dental staff at Rhode Island Hospital and a dental consultant on the staff of Our Lady of Fatima Hospital. From 1934 to 1938 he was dentist for the Providence School Department.

Dr. Messore is a past president of the Rhode Island Dental Society and belongs to various professional organizations. He is a Fellow of the American College of Dentists.

PERIODONTISTS TO VIEW RECENT TECHNICS IN APRIL

Saul Schluger of Jersey City will demonstrate recent developments in periodontal therapy at the April 27 and 28 meeting of the Southwestern Society of Periodontists in Houston, Texas. Dr. Schluger will also discuss problems of treatment submitted to him by members of the society. The April meeting is the society's first annual session.

President of the group is John Swindle of Waco, Texas. James W. Clark of Texarkana is president-elect, and George R. Spear of San Antonio is secretary.

APRIL MAGAZINE CARRIES STORY ON TOOTHPASTE CLAIMS

An article on dentifrices and dentifrice ads will appear in the April issue of *Changing Times*, the Kiplinger magazine. The article, entitled "What to Make of

Those Tooth Paste Ads," tells of the claims made for the ammoniated, chlorophyll, antienzyme and fluoride toothpastes and describes the American Dental Association position on these dentifrices. The article was prepared in cooperation with the Association's Bureau of Public Information. Sample copies of the magazine containing the article can be obtained on request from *Changing Times*, 1729 H. Street, N.W., Washington 6, D. C.

NORTHWESTERN ALUMNI TO HEAR HEALTH EDITOR

T. R. Van Dellen, M.D., health editor of the Chicago Tribune and president of Northwestern University Alumni Association, will be guest speaker at the annual homecoming reunion of the school's dental alumni. The reunion will be at the school in Chicago April 24. Dr. Van Dellen will speak on the medical hazards of dentistry. Table clinics and a tour of modernized dental school facilities will complete the program.

JULY DATE SET FOR PEDODONTICS EXAMINATION

The next examination to be given by the American Board of Pedodontics will be held at the College of Physicians and Surgeons School of Dentistry in San Francisco July 25-27. Candidates may write to Ralph L. Ireland, secretary of the Board, College of Dentistry, University of Nebraska, Lincoln 8.

DENTAL MEDICINE ACADEMY SPONSORS SYMPOSIUM ON PAIN

Panelists will discuss causation and management of pain by surgical and nonsurgical methods at a three day meeting of the American Academy of Dental Medicine May 29 through June 1 in Boston.

Among participants are Abram Chasens, D.D.S., of New York University College of Dentistry; Edward A. Edwards, M.D., and Milton Greenblatt, M.D., of Harvard Medical School; Gilbert Horrax, M.D., and Frank D. Lathrop, M.D., of Lahey Clinic in Boston; Philip Sheridan, D.M.D., department of oral surgery, St. Francis Hospital in Hartford, Conn.; Benjamin Spector, M.D., and John F. Sullivan, M.D., of Tufts University School of Medicine, and Harold Wolff, M.D., of Cornell University Medical School.

Reservations may be obtained from Arthur Gold, D.D.S., Academy program chairman, 26 Maple St., Springfield 3, Mass.

FOUR PROMINENT CLINICIANS HIGHLIGHT PACIFIC MEETING

Four nationally known clinicians will highlight the August 19-22 Pacific Coast Dental Conference in San Diego, announces C. W. Gilman of National City, Calif., Conference secretary. They are Vincent R. Trapozzano of St. Petersburg, Fla., who speaks on prosthodontics; Miles R. Markley of Denver, who will discuss the three-quarter crown as well as amalgam foundations for cemented restorations; Mr. James Robinson, executive secretary of the Southern California State Dental Association, who speaks on patient and office management, and Saul Schluger of Jersey City, whose topic is periodontics and splinting.

An extensive recreation program is planned to supplement the scientific program. The entertainment includes a tour of San Diego harbor, a fashion show, a tour of the famed San Diego Zoo and a dinner-dance at the Hotel Del Coronado.

Dental assistants and dental hygienists will meet in conjunction with the Pacific Coast Dental Conference and will organize their own scientific and entertainment program, according to Miss Mary Rowley of La Mesa, Calif., the dental assistants' general chairman.

Registration for the Conference may be made through Dr. Gilman, 219 E. 8 St., National City, Calif.

GEORGE HARE CHOSEN HEAD OF ENDODONTISTS' ASSOCIATION

George C. Hare of Toronto, Canada, has been chosen president of the American Association of Endodontists. The new president-elect is George G. Stewart of Philadelphia. Other officers are: J. Henry Kaiser of Columbus, Ohio, vice-president; Vincent B. Milas of Chicago, secretary; Paul P. Sherwood of Cleveland, treasurer, and Victor H. Dietz of St. Louis, editor.

INSTALL OFFICERS OF PERIODONTOLOGISTS' SOCIETY

The Western Society of Periodontology installed Nathan Friedman of Beverly Hills, Calif., as president at its fourth annual meeting in Las Vegas, Nev., March 15-17. Dr. Friedman succeeds Ralph E. Stoker of Huntington Park, Calif.

Chosen president-elect was Sylvan S. Schireson, also of Beverly Hills. Roy L. Arnett of Pasadena, Calif., was elected vice-president, and Howard A. Tyrrell of San Diego, treasurer. The new editor is Perry A. Ratcliff of San Bernardino, Calif.

CORRECTION

An error occurred on page 380 of the March issue of THE JOURNAL. Cooke-Waite Laboratories' product Ravocaine and Novocain with Cobefrin (RNC) is marketed in 2.2 cc. minimum cartridges and in 30 cc. multiple dose vials, not in lots of 300 cc.

The following advertisement was unavoidably left out of the classified advertisement section.

Iowa oral surgeon desires associate. Excellent opportunity. Must have formal oral surgery training. State qualifications, age, institutions of training, references. Address: A.D.A. Box No. 573.

Also • A nation-wide television program on dentistry was presented March 3 on the "Medical Horizon" series. The documentary report on the prevention and control of dental diseases was presented as a public service by Ciba Pharmaceutical Company in cooperation with the American Dental Association and the American Medical Association. It originated "live" from the Dental Branch, University of Texas. . . . A certification examination will be held by the Ohio State Dental Assistants Association May 18 in Toledo. Information may be obtained from Alberta E. Reed, secretary of the association, 753 Franklin Rd., N.E., Massillon, Ohio. . . . Tickets for the testimonial dinner for Lee Roy Main, dean of the School of Dentistry of St. Louis University, may be obtained from Joseph Grana, 7266 Manchester, Maplewood 17, Mo. . . . Members of the American Society of Dentistry for Children interested in presenting table clinics at the society's Miami Beach, Fla., meeting in November are asked to mail applications to Bernard Neuwirth, 220 Miracle Mile, Coral Gables, Fla. . . . Two Oregon Democrats, Senator Neuberger and Representative Porter, have introduced identical bills to set up a National Radiation Health Institute in Bethesda, Md. Its job would be to coordinate research in atomic and nuclear radiation effects on human health. . . . Walter Emerson Briggs of Attleboro, Mass., has been named dentist of the year by the Massachusetts Dental Society.

The Reader Comments

BELIEVES DENTAL SOCIETIES SHOULD SUPPORT FLUORIDATION

I would like to comment on the remarks regarding fluoridation made in this column by Reuben Feltman in the February issue of THE JOURNAL.

Dr. Feltman holds that it is not a proper function of the American Dental Association or its component societies to promote fluoridation. I feel that there can be nothing further from the truth. Not only is promotion of this procedure the responsibility of organized dentistry but it is that of each individual practitioner, and every effort must be exerted for its adoption.

Fluoridation as a public health measure has had applied to it every conceivable yardstick to measure its safety and effectiveness. With this knowledge in hand, it might well be termed neglect on the part of the dental profession were it to take either a back seat or merely to endorse the measure passively.

Most apropos to this question of promotion of fluoridation by the dental profession is the action taken by the American Medical Association on polio vaccination. Dwight H. Murray, M.D., president of the A.M.A., in a recent talk stated, "Apathy over polio has been so bad that a few weeks ago the A.M.A. called in representatives from all the states and territories to launch a program to get the entire population, particularly those up to age 40, inoculated with the Salk vaccine. Polio is just one area where we have spent years of research and millions of dollars in search of something, and then after we've found it, too many persons refuse to use it."

Doesn't that last sentence describe the fluoridation situation?

I think Dr. Feltman is not so much opposed to the promotion of fluoridation as he is to fluoridation per se, and for him to suggest that "we get out of this fight" and to talk about the Public Health Service taking the credit or blame is to be both naive and misleading.

I would like to quote from a previous evaluation of the antifluoridationists.

"We consider the hubbub and the furor about it to be absurd, and especially do we regard the busy gyrations of noisy, untutored and self-appointed protectors of the public in this matter to be a shoddy exhibition. I have no doubt that there are honest people involved, but some of us who have spent a lifetime of study in this and related fields may be forgiven, perhaps, if we resent the pretensions of some of these all-wise, presumably intuitive charlatans and ignoramuses, and if we feel that sensible people might reasonably be expected to take their advice from us rather than from them."

Leonard F. Menczer, D.D.S., M.P.H., Hartford, Conn.

DENTAL INVESTIGATIONS IN KOREA

In Seoul, Korea, the Severance Hospital Dental Department during 1956 examined four groups of nursing, medical and theological students. Careful clinical examination was made with mouth mirror and explorer under a dental light. Of 195 men and women students, ranging in age from 19 to 49 years and averaging 26 years of age, 66 had no decay, missing teeth or fillings. The average DMF rate was 2.6. In order to check the clinical examination, bitewing roentgenographic examination was made of one group.

This rather startling freedom from dental decay might be a fit subject for etiological study.

John McInnes, D.D.S., Seoul, Korea

DENTAL CARE FOR EMOTIONALLY DISTURBED CHILDREN

For the past 15 years I have been taking care of the dental needs of children at the Children's Village, Dobbs Ferry, N. Y. This organization is a residential school for emotionally disturbed boys between the ages of 10 and 17.

I would like to contact other dentists who have been dealing with emotionally disturbed boys in order to form a society to further knowledge in this field. I would be happy to correspond with any dentist who is interested.

Jesse Myers, D.D.S., Dobbs Ferry-on-Hudson, N. Y.

COUNCIL ON DENTAL TRADE AND LABORATORY RELATIONS

Accreditation plan for New Hampshire dental laboratories

In recent months, the Council on Dental Trade and Laboratory Relations has received numerous inquiries from officers of constituent societies concerning the state level accreditation of dental laboratories. In order to provide information on this matter to all readers of THE JOURNAL, the Council presents below the full text of the accreditation plan recently adopted by the New Hampshire Dental Society. The New Hampshire program is administered by an accreditation board on which the dental society and the New Hampshire Dental Laboratory Association have equal representation. In the event of a tie vote, the issue is referred to the presidents of the two societies and a member of the clergy acceptable to both presidents. Additional copies of the New Hampshire plan as well as copies of accreditation plans adopted by other constituent societies can be obtained from the Council on request.

DEFINITION

I. Accreditation of dental laboratories is the recognition by the New Hampshire Dental Society of dental laboratories which meet the requirements and standards for dental laboratories as set up by the prosthetic dental service committee of the New Hampshire Dental Society and New Hampshire Dental Laboratory Association.

PURPOSE

II. The purpose of this program is to develop and maintain a mutually helpful relation between the dental profession and the dental laboratories:

A. by encouraging dental laboratories to improve the quality and efficiency of the services.

B. by providing to dentists a means of selecting a dental laboratory whose workmanship, efficiency and adherence to the laws that are related to the laboratories' activities, meet the requirements established by the New Hampshire Dental Society.

ADMINISTRATION

III. The administration of accreditation of dental laboratories is under the direction of the prosthetic dental service committee of the New Hampshire Dental Society which will appoint an accreditation board. The accreditation board will consist of four members, two members chosen by the New Hampshire Dental Society and two members chosen by the New Hampshire Dental Laboratory Association. One shall be elected as chairman and one as secretary. The chairmanship shall alternate between the dental and laboratory members every year.

The president and secretary of these organizations shall be members ex officio without voting power. The first year one dental member shall be elected to serve four years, one laboratory member for three years, one dental member for two years, one laboratory member for one year. Thereafter one member shall be elected to serve for four years.

In the event of a tie vote, the presidents of both organizations and a member of the clergy agreeable to both presidents will comprise the Board of Arbitration and their vote is final.

FEES

IV. The annual fee for accreditation shall be ten dollars ($10.00) for all laboratories with five or less technicians. The annual fee for laboratories with more than five employees shall be on a basis of two dollars ($2.00) per technician employee, with a maximum annual fee of one hundred dollars ($100.00) The fee is to accompany the application for accreditation. The fee is not returnable if accreditation is revoked. Laboratories with fluctuating numbers of technicians will pay fees according to the average number of technician employees during the previous year. This fee is to stand for the first year of accreditation and is subject to adjustment by the accreditation board.

The fees obtained from accreditation will be used by the board for expenses incurred during the administration of this program.

APPLICATION FOR ACCREDITATION

V. Any dental laboratory having been established for one year or more and who is a member in good standing of the New Hampshire Dental Laboratory Association may apply for accreditation to the secretary of the New Hampshire Dental Laboratory accreditation board. The board will then investigate and inspect the applicant dental laboratory and the board will then accredit any dental laboratory which has met the requirements and inspection.

If approval for accreditation is denied by the accreditation board, the laboratory may reapply in writing within 90 days without charge. If accreditation is further denied, the laboratory may appeal to the arbitration board as set up in Section III.

CERTIFICATE OF ACCREDITATION

VI. The accreditation board shall issue to each accredited laboratory an appropriate certificate. This certificate shall be renewed annually on the continued evidence of acceptability and payment of annual fee.

A. If approval for renewal is denied by the accreditation board, the laboratory may appeal to the Arbitration Board of Section III.

B. In case of revocation by the accreditation board, the laboratory may appeal to the arbitration board of Section III.

REQUIREMENTS FOR ACCREDITATION

Dental laboratories must meet the following minimum requirements to be eligible for accreditation:

1. Must not violate nor permit technicians in their employ to violate the current dental laws of the State of New Hampshire.

2. Must render services only to legal practitioners of dentistry.

A. This section does not prohibit the construction of demonstration cases for laboratories or manufacturers.

3. Must not employ, nor retain in their employ, any technician who has been found guilty of a violation of a dental law in a court of record of any State, without the approval of the accreditation board.

A. An accredited laboratory may hire a technician who has been found guilty of violation of a dental practice act only with the approval of the accreditation board.

4. Must conform to the regulations and prevailing standards of sanitation, health, labor and safety of the State of New Hampshire and the community in which they operate.

5. Must not, by any means, method, or device, advertise to the general public.

6. Must not advertise services, technics, or prices on the radio, or in any newspaper, magazine, periodical, or any other publication available to the general public.

7. Must not advertise prices on any open or exposed mailing form.

8. Must not make statements or implications in advertising which are deceptive or misleading.

9. Must comply with, and follow explicitly the written prescriptions of the legal practitioner of dentistry for the construction or fabrication of any dental appliance which it accepts for construction or fabrication when they are furnished by the dentist.

A. This section is interpreted to mean that no change of design nor substitution of materials may be made without the knowledge and approval of the legal practitioner of dentistry who requires the service, except by previous mutual understanding.

10. Must deliver with each completed dental appliance an itemized statement showing the name and quality of materials used in its fabrication.

11. Must have a staff of technicians adequately trained for the types of work which they are doing.

A. The interpretation of this requirement will be made by the accreditation board to conform to local conditions.

12. Must have adequate equipment for doing the types of work which are accepted by the laboratory.

13. Must have satisfactory credit relations.

14. Must agree to, and abide by the Code of Ethics prescribed by the New Hampshire

Dental Society and New Hampshire Dental Laboratory Association.

CODE OF ETHICS

In order that dental laboratories may work harmoniously together for the best interest of themselves and the dental profession which they serve, the following Code of Ethics is prescribed:

General Deportment • 1. It is the duty of every dental laboratory, and it shall be incumbent upon every accredited laboratory to govern its deportment in accordance with the underlying principles which have motivated the formulation of this Code.

Advertising • 2. All advertising by dental laboratories shall be directed to the dental profession.

3. Ethical advertising by dental laboratories may appear in magazines, journals, or bulletins which are distributed only to dentists, dental laboratories and dental manufacturers.

4. It is unethical to advertise prices in any manner other than a sealed communication.

5. Advertising must be honest and in no way untrue, deceptive, or misleading.

6. Signs may be used at the place of business of the dental laboratory, provided they are not of such a size or nature as to attract the attention of the general public.

Discrimination and Price Cutting • 7. It shall be considered unethical to discriminate against any dentist by offering or rendering services at a price different than that offered to any other dentist on like terms.

8. It shall be considered unethical to have secret agreements to sell or offer for sale any service, merchandise, or dental appliance at less than the cost of making, building, constructing, fabricating, or replacing the same, except when a laboratory may remake, adjust, or repair to the satisfaction of the legal practitioner of dentistry a defective dental appliance previously constructed by that laboratory.

Unfair Practices • 9. It shall be considered unethical to mark or invoice falsely any product of a dental laboratory which would tend to mislead or deceive or defraud legal practitioners of dentistry as to the grade, quality, quantity, substance, character, nature, origin, size, finish, preparation, or fabrication of the product.

10. It shall be unethical to defame, malign, or falsely accuse any laboratory or dentist of dishonorable conduct, inability to perform services, disparagement of the grade or quality of their materials or service, or to make any other false representations regarding them.

11. It shall be considered unethical to conspire with, aid, or abet any person in the dental laboratory industry or in the dental profession in any unfair competitive practice.

12. It shall be considered unethical to conspire to fix prices in violation of the anti-trust laws of the State of New Hampshire or of the United States.

BUREAU OF DENTAL HEALTH EDUCATION

National Children's Dental Health Week 1957

The 1957 observance of National Children's Dental Health Week was held February 3-9. Although it is difficult to make a qualitative evaluation of the event, from a quantitative point of view, it was a success. More posters (224,068) and more program kits (4,206) were requested and distributed than ever before. All 48 states and Alaska, Hawaii, Puerto Rico, District of Columbia, Virgin Islands, Panama Canal Zone and four foreign countries received supplies of materials. Incomplete returns show that materials were sent to 1,352 individuals in 1,194 communities.

Special television spot announcements previously produced by the Association were revised and adapted for use during National Children's Dental Health Week. One hundred sets of three each of the spots were purchased. Ninety-five sets were sold to dental societies and health departments for use on local television

programs. In addition, 325 television scripts and 83 sets of flip cards were distributed to local dental societies at no cost.

The Bureau of Public Information prepared the television, radio and speech material for the program kit and did an excellent job of handling promotion and publicity for the observance.

The NCDHW program for 1957 was operated in the following manner: In early summer of 1956, letters were sent to all state dental society secretaries requesting the name of the NCDHW chairman for the coming year. When these names were received, the Bureau then asked the chairmen for a list of people in their state who should be sent materials and for quantities needed. Packets and posters were distributed beginning in August 1956. Television scripts and accompanying flip cards were made available at a later date.

It is not too early to start thinking about the 1958 NCDHW observance. State chairmen and committees can be appointed and initial plans made on the basis of last year's experience. All local dental societies should be asked to appoint their chairman early so that the state chairmen can have a complete list of dentists in each community who will have the responsibility for next year's program.

If all state chairmen know what their requirements for promotional materials will be, early fall allocation and distribution of requested materials by the Bureau of Dental Health Education will be simplified.

COUNCIL ON DENTAL EDUCATION

Additional hospital dental internships and residencies approved by the Council on Dental Education (supplement 7)

The Council on Dental Education and its Committee on Internships and Residencies has announced the approval of additional educational programs in several hospitals. Previous listings of approved internships and residencies appeared in the May 1954, August 1954, February 1955, May 1955, August 1955, February 1956 and September 1956 issues of THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION. Since changes in the status of approved programs and notice of additional programs approved are published periodically in THE JOURNAL, it is important that the applicants review all of the references cited above when seeking complete and current information.

All of the internships and residencies that have been approved or provisionally approved are recognized by the Council on Dental Education as accredited. The training programs designated with a double asterisk (**) are provisionally approved; all others are approved.

Hospital	Type of program approved	Length of program approved (months)	Number of positions available	Date the service begins
ALABAMA				
Veterans Administration Hospital 700 So. 19th Street Birmingham, Alabama Dr. Frederick W. Kraus, Chief of Dental Service	Residency Periodontics Prosthodontics	 24 24	 1 1	 July July
CALIFORNIA				
Los Angeles County Hospital 1200 N. State Street Los Angeles, California Dr. Paul H. Hamilton, Chief of Dental Service	Residency Oral surgery	 12	 2	 July
Veterans Administration Center Los Angeles, California Dr. Earl B. Rousseau, Chief of Dental Service	Internship Rotating	 12	 1	 July
DISTRICT OF COLUMBIA				
Children's Hospital of D.C. 2125 - 13th Street, N.W. Washington, D.C. Dr. Harold N. Greenberg, Chief of Dental Service	Internship Pedodontics	 12	 1	 July
Providence Hospital 12 and Varnum Street, N.E. Washington, D.C. Dr. John S. Keaveny, Chief of Dental Service	Internship Rotating	 12	 2	 July
LOUISIANA				
Confederate Memorial Medical Center 1541 Kings Highway Shreveport, Louisiana Dr. D. R. Isom, Chief of Dental Service	Internship Oral surgery	 12	 1	 July
MISSOURI				
Mercy Children's Hospital 1710 Independence Avenue Kansas City 6, Missouri Dr. William J. Carter, Chief of Dental Service	Internship Pedodontics	 12	 2	 July
**Veterans Administration Hospital 4801 Linwood Boulevard Kansas City, Missouri Dr. James P. Darnell, Chief of Dental Service	Residency Oral surgery	 24	 1	 July
NEW YORK				
Bronx Municipal Hospital Center Pelham Parkway & Eastchester Road Bronx, New York Dr. Stanley L. Lane, Chief of Dental Service	Internship Rotating Oral surgery Residency Oral surgery	 12 12 12	 2 2 2	 July July July

Hospital	Type of program approved	Length of program approved (months)	Number of positions available	Date the service begins
Veterans Administration Hospital 408 First Avenue New York, New York Dr. Irwin W. Scopp, Chief of Dental Service	Residency Oral surgery	12	1	July
U.S. Public Health Service Hospital Bay and Vanderbilt Avenue Stapleton, S.I., New York Dr. Robert A. Scroggie, Chief of Dental Service	Residency Oral surgery	12	1	July
NORTH CAROLINA Charlotte Memorial Hospital 200 Scott Avenue Charlotte 3, North Carolina Dr. Edward U. Austin, Chief of Dental Service	Internship Rotating	12	1	July
PENNSYLVANIA Albert Einstein Medical Center (Northern Division) York & Tabor Roads Philadelphia 41, Pennsylvania Dr. I. B. Bender, Dr. Gustav C. Tassman, Chiefs of Dental Service	Internship Rotating	12	—	July
TEXAS Robert B. Green Memorial Hospital 515 Morales San Antonio 7, Texas Dr. John W. Helton, Dr. Frank C. Sammis, Jr., Chiefs of Dental Service	Internship Oral surgery	12	1	July
WISCONSIN Veterans Administration Center Wood, Wisconsin Dr. L. E. Wilde, Chief of Dental Service	Internship Rotating	12	2	July

The following change has been made in the list of approved internship and residency programs published in the May 1954 issue of THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION. The Council has approved the second year of the residency in oral surgery at the Highland-Alameda County Hospital, Oakland, California, so the listing now appears as follows:

CALIFORNIA Highland-Alameda County Hospital 2701 Fourteenth Avenue Oakland, California Dr. James H. Hechtman, Chief of Dental Service	Internship Oral surgery Residency Oral surgery	12 24	1 2	July July

BUREAU OF LIBRARY AND INDEXING SERVICE

Additions to the Library

The books listed here have been added recently to the Library collection. Requests for this material, available on loan to all members of the Association, should be addressed to the Bureau of Library and Indexing Service. There is no charge for borrowing these books. Most of these books may be purchased through the Bureau. Practically all the dental journals published in the world are available also to borrowers.

BOOKS

ACKERKNECHT, E. H. Rudolf Virchow; doctor, statesman, anthropologist. Madison, Univ. of Wisconsin Press, 1953. 304 p. $5.

ADAMS, W. C. History of dentistry in Oregon. Portland, sponsored by the Oregon State Dental Association and the Oregon State Board of Dental Examiners, 1956. 343 p. $7.50.

ALBANESE, PAOLO. Le parodontopatie; clinica e terapia immunitaria della piorrea alveolare malattia allergica. 2d ed. Florence, *Rivista Italiana di Stomatologia*, 1956. 112 p.

AMERICAN DENTAL ASSOCIATION. American dental directory, 1957. Chicago, 1957. 1,110 p. $7.50.

AMERICAN DENTAL ASSOCIATION. BUREAU OF LIBRARY AND INDEXING SERVICE. Audio-visual materials in dentistry; supplement I. Chicago, 1957. 31 p.

AMERICAN DENTAL ASSOCIATION. COUNCIL ON DENTAL THERAPEUTICS. Accepted dental remedies; including a list of accepted products together with other information compiled to promote rational therapeutics in dentistry. 22d ed. Chicago, 1957. 212 p. $2.

THE AUDIO-VISUAL EQUIPMENT DIRECTORY. 3d ed. Evanston, National Audio-Visual Association, 1956. 196 p. $3.75.

THE BAYLOR BURR; 50th anniversary special issue. Dallas, 1956. 224 p.

BERRY, E. C. & KOHN, M. L. Introduction to operating-room technique. New York, McGraw-Hill, 1955. 154 p. $4.

BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS. Transactions, 1955. London, Wright, 1956. 192 p.

CIPES, L. R. Prescription writing and materia medica for dentists. 4th ed. Brooklyn, Dental Items of Interest, 1956. 598 p. $9.50.

CLEMENTS, F. W. The teeth and food. (The Annie B. Cunning lectures on nutrition No. 8). Sydney, Royal Australasian College of Physicians, 1955. 20 p.

COHEN, H. M. Pediatric dentistry. St. Louis, Mosby, 1957. 607 p. $14.75.

COMMERCE CLEARING HOUSE. Explanation of social security law as amended in 1956. Chicago, 1956. 144 p. (Distributed by American Dental Association.)

DARCISSAC, E. - P. Parodontites pyorrhéiques; gingivites superficielles et profondes. Étude clinique et thérapeutique précédée d'une analyse des ouvrages de M. Roy, Ch. Hulin et A. J. Held. Paris, Prélat, 1956. 78 p.

DESANCTIS, A. G., editor. Handbook of pediatric medical emergencies. 2d ed. St. Louis, Mosby, 1956. 389 p. $6.25.

DULAC, G. L. Études sur la précision en radiodiagnostic, techniques d'un nouveau craniographe, notation angulaire de l'incidence. Paris, Masson, 1956. 134 p.

EUROPEAN ORTHODONTIC SOCIETY. Report of the thirty-first congress held at the Grand Hotel, Rome, Italy, October 3rd, 1955. The Hague, 1955. 348 p.

FEDERAL CIVIL DEFENSE ADMINISTRATION. Cue for survival; operation cue A. E. C. Nevada test site May 3, 1955. A Report. Washington, Govt. Print. Off., 1956. 162 p. $0.50.

FORTSCHRITTE DER KIEFER- UND GESICHTSCHIRURGIE; ein Jahrbuch. Edited by Karl Schuchardt and Martin Wassmund. Vol. 2. Stuttgart, Thieme, 1956. 268 p. $14.30.

FRY, W. K. & WARD, TERENCE. The dental treatment of maxillofacial injuries. 2d ed. Springfield, Ill., Thomas, 1956. $9.50.

GARCIA GODOY, F. Compendio de odontologia infantil. Ciudad Trujillo, 1956. 150 p.

GRAHNEN, HANS. Hypodontia in the permanent dentition; a clinical and genetical investigation. (Odontologisk Revy, Vol. 7, Sup. 3). Lund, Gleerup, 1956. 100 p.

GREAT BRITAIN. COMMITTEE ON RECRUITMENT TO THE DENTAL PROFESSION. Report. London, H. M. Stationery Off., 1956. 61 p.

HJORTSJÖ, C. - H. Studies on the mechanics of the temporomandibular joint, Lund 1951-1954. Lund, Gleerup, 1955. 24 p. $1.

INDIANA UNIVERSITY. AUDIO-VISUAL CENTER. Educational television motion pictures 1956

catalog. Descriptive catalog containing series data, subject and use; level index for 16 mm. educational television programs. Bloomington, 1956. 149 p.

INTERPROFESSIONAL COOPERATION FOR THE IMPROVEMENT OF OUR HEALTH AND WELFARE; papers delivered at a Conference on Health and Rehabilitation, the third in a series of Anniversary celebrations, January 23, 24, 25 and 26, 1956. (Hine, M. K. Dentistry's role and responsibility in the health services, p. 67-84). Milwaukee, Marquette Univ. Press, 1956. 125 p.

JØRGENSEN, K. D. The deciduous dentition; a descriptive and comparative anatomical study. (Acta Odontologica Scandinavica, Vol. 14, Sup. 20). Copenhagen, 1956. 202 p.

KUMATA, HIDEYA. An inventory of instructional television research. Ann Arbor, Mich., Educational Television and Radio Center, 1956. 155 p. $1.

LAMMIE, G. A. Full dentures. Oxford, Blackwell, 1956. 212 p. $7.

MATSUMYA, SEIICHI; KONDO, SABURO; TAKUMA, SHOSABURO; SUZUKI, ATSUMI & OSAWA, YASUKAZU. Atlas of oral pathology. Tokyo, Tokyo Dental College Press, 1955. 2 v. $15.

MELLAN, IBERT & MELLAN, ELEANOR. Dictionary of poisons. New York, Philosophical Library, 1956. $4.75.

THE MERCK MANUAL OF DIAGNOSIS AND THERAPY. 9th ed. Rahway, N. J., Merck & Co., 1956. 1,870 p. $6.75.

MUHLER, J. C. & HINE, M. K., editors. A symposium on preventive dentistry; with specific emphasis on dental caries and periodontal diseases. St. Louis, Mosby, 1956. 266 p. $6.75.

ORBAN, B. J., editor. Oral histology and embryology. 4th ed. St. Louis, Mosby, 1957. 379 p. $9.

ORTHODONTIC DIRECTORY OF THE WORLD. 18th ed. Edited by Oren A. Oliver and William H. Oliver. Nashville, Tenn., American Association of Orthodontists, 1956. 245 p.

PRADO VALLEJO, GONZALO. Encuesta sanitaria dental; la salud dental conseguida mediante metodos preventivos es la obligacion del estado, el deseo de la poblacion y la suprema aspiracion de la odontologia sanitaria. (Revista Ecuatoriana de Higiene y Medicina Tropical, Vol. 12, No. 3). Guayaquil, Ecuador, 1955. 124 p.

PROELL, FRIEDRICH. Zahnaufbau und Zahnzerfall in Abhängigkeit von der Ernährung; aufklärender Beitrag zum Kariesproblem. Leipzig, Barth, 1956. 118 p. $5.

SAVITT, R. A. Teeth, trauma and the dentist-patient relationship. (Reprinted from the Journal of the Hillside Hospital, Vol. 5, Numbers 3-4, October 1956). Glen Oaks, N. Y., 1956. 10 p.

SHARP, JACOB. A history of the Connecticut State Dental Association 1864-1956. New Haven, Connecticut State Dental Association, 1956. 262 p. $5.

SHIELDS, S. W. Brevity is the soul! Seymour, Ind., Mercer, 1955. 141 p. $2.75.

SYDSVENSKA TANDLÄKARE-SALLSKÄPET 1906-1956; en historik. Lund, Gleerup, 1956. 245 p. $6.16.

TAVIANI, SIRO. Metodica iconografica di morfologia dentale umana. Vol. I: Molari superiori permanenti. Cagliari, Instituto di Antropologia dell'Universita, 1956. 120 p.

U. S. DEPT. OF HEALTH, EDUCATION, AND WELFARE. OFFICE OF EDUCATION. A directory of 3,300 16 mm. film libraries. Washington, Govt. Print. Off., 1956. 198 p. $0.70.

U. S. PUBLIC HEALTH SERVICE. DIVISION OF DENTAL RESOURCES. A study of dental manpower requirements in the West, by Division of Dental Resources, U. S. Public Health Service for Western Interstate Commission for Higher Education in cooperation with W. K. Kellogg Foundation and Council on Dental Education, American Dental Association. Washington, Govt. Print. Off., 1956. 247 p.

UNIVERSITY OF PENNSYLVANIA. SCHOOL OF DENTISTRY. Caries control procedures. Compiled by Robert E. De Revere. Philadelphia, 1956. 37 p.

WESPI, HANSJAKOB. Fluor-Vollsalz zur Kropf- und Caries- Bekämpfung. Basel, Schwabe, 1956. 58 p. 4.50 Fr.

WORLD HEALTH ORGANIZATION. The work of WHO 1955; annual report of the Director-General to the World Health Assembly and to the United Nations. (Official Records of the World Health Organization, No. 67). Geneva, 1956. 241 p. $2.

WRIGHT, W. R. An account of early dentistry in Mississippi and a limited history of the Mississippi Dental Association 1875-1956. Jackson, Miss., 1956. 84 p. Mimeo.

ZIEGLER, EUGEN. Untersuchungen über die Fluorierung der Milch zur Cariesprophylaxe. (Reprinted from Mitteilungen der Naturwissenschaftlichen Gesellschaft Winterthur, No. 28, 1956). Winterthur, Switzerland, 1956. 63 p.

The American Dental Association Film Library

The films reviewed in this article are available for rental ($2.50 each) from the Film Library, 222 E. Superior St., Chicago. The booklet, *Audio-Visual Materials in Dentistry,* and the supplement should be consulted regarding additional films on dental health and oral surgery.

FILM REVIEWS

Teeth: Their Structure and Care • 16 mm., color, sound, ten minutes. Produced in 1956 by Coronet Instructional Films, Chicago. Collaborator on scientific content, J. Robert Schumaker, D.D.S., M.S.D., professor of histology, Northwestern University Dental School. Cleared for television, arrangements for which should be made with the producer. Purchase ($55 black and white, $100 color) also may be made from producer, 65 E. South Water St., Chicago 1, Ill. For junior and senior high school health classes.

The film opens with Dave and his sister in the dentist's office. Flashbacks show how Dave had been neglecting recurrent toothaches. The next sequences are concerned with the dentist's interpretation of Dave's roentgenograms which clearly show tooth decay. Through animation, the function of different teeth, the structure of a tooth and the progress of tooth decay are shown. The film concludes with a demonstration by Dave of correct toothbrushing and proper diet. This film is well organized. The format, however, is typical of most dental health films. The presentation of the dental health material is stereotyped. An attempt is made in all these films to cover too many points. It is suitable for use by dental societies in dental health programs with teen-age groups and parents.

Root Recovery • 16 mm., color, sound, 32 minutes. Produced in 1955 by the State University of Iowa College of Dentistry. Photography by the Bureau of Audio-Visual Instruction, State University of Iowa. Film may be purchased ($230) from the producer, Iowa City.

This teaching film demonstrates instrumentation and technics used in the surgical removal of root fragments, with special emphasis on surgical procedures. The film opens showing the instructor in a dental school discussing the causes of fractured roots. These causes are demonstrated on models, specimens and later on a patient who undergoes complete removal of upper and lower teeth and an alveolectomy. The patient is draped for surgery and given premedication. The surgical instruments to be used are placed behind the patient not only for efficiency but for psychological reasons.

The operator then makes a careful study of the full mouth roentgenograms. A right inferior alveolar injection is given. The steps to be followed are explained. A left inferior alveolar injection is made in a similar manner. The patient is tested for anesthesia. The lower teeth are exposed. The flap is reflected. A periosteal elevator is used to assist in the extraction which is begun in the posterior of the mouth. Explanations and demonstrations of various procedures and instruments used to extract roots fractured for demonstration purposes precede and follow each root removal. A rongeur forceps is used to remove irregular bone. The flaps are returned to position and sutured. The upper teeth are extracted in a similar manner. Postoperative instructions are given the patient. Four or five days postoperatively the sutures are removed and the patient returns for follow-up treatment.

This is an excellent teaching film. The various kinds of fractures and the root recovery problems presented are dealt with intelligently and pedagogically. The photography is good. The use of models, specimens, drawings and demonstrations on the patient increase the instructional value of the film. It should be of interest to general practitioners, endodontists and exodontists. It will provide suitable program material for dental society study clubs and hospital dental staffs.

Correction • On page 24 of the printed supplement to the booklet, *Audio-Visual Materials in Dentistry,* Carr, John, should be corrected to read Carr, E. Leonard, and the name Fredrickson, E. J., D.D.S., 521 Medical Center Bldg., Spokane, Washington, should be inserted after Fong, March K., Ph.D.

COUNCIL ON DENTAL RESEARCH

Alginate impression materials

H. J. Caul, B.S., Washington, D. C.

Alginate impression materials came into use during World War II as a replacement for the then scarce agar that had served the profession since the early nineteen-thirties. The alginate materials have largely displaced agar-containing impression materials because of the simple equipment required and convenience in use even though at times the results in accuracy have been disappointing.

Phillips,[1] Skinner and others[2-4] have shown that when alginate is used properly, the resulting gypsum models are as accurate as those obtained with agar-base impression materials. Replies to a recent questionnaire sent to several dental laboratories indicate that these research findings seem not to hold in clinical practice. According to this survey, remakes of partial dentures made from alginate impressions are two to four times that of those made from agar impressions. These differences between the experiences of commercial dental laboratories and research laboratories are probably caused by improper handling of the alginate materials in practice. The alginates are more delicate from a handling standpoint than agar since many of the manipulative variables are mechanically controlled with the reversible hydrocolloids. This discussion will attempt to explain some of the differences between alginate and agar materials and also to outline a general technic that will avoid many of the inaccuracies in the use of alginate impression materials.

Agar, a colloid extracted from seaweed, is the important ingredient in the reversible hydrocolloidal impression materials. These materials are reversible because the sol or fluid form can be converted to the gel or solid form by cooling and reconverted to the sol on reheating. The gelation temperature of agar-containing materials is usually just above mouth temperature. The difference between the sol and gel is a physical change dependent on temperature.

The alginates are salts of alginic acid which is obtained from marine kelp. The alginates change from the sol to the gel form by a chemical reaction that is irreversible. The sol form is always a soluble salt of alginic acid. The gel is an insoluble alginic acid salt.

The essential constituents of alginate impression powders are the soluble alginate, a reactor such as calcium sulfate, and a retarder such as trisodium phosphate. When the alginate impression powder is mixed with water, all three ingredients start dissolving. The retarder ties up the reactor for a short time so that the reactor is not available for converting the soluble alginate to the insoluble alginate or gel form. As soon as the retarder has been spent, gelation begins throughout the powder-water mixture. The time required to consume the retarder is usually several minutes and is

Research associate, National Bureau of Standards division of the Council on Dental Research, American Dental Association.

1. Phillips, R. W.; Price, R. R., and Reinkin, R. H. Use of alginate for indirect restorations. J.A.D.A. 46:393 April 1953.

2. Skinner, E. W., and Pomes, C. E. Dimensional stability of alginate impression materials. J.A.D.A. 33:1253 Oct. 1946.

3. Skinner, E. W.; Cooper, E. N., and Beck, F. E. Reversible and irreversible hydrocolloidal impression materials. J.A.D.A. 40:196 Feb. 1950.

4. Skinner, E. W., and Hoblit, N. E. Study of the accuracy of hydrocolloidal impressions. J. Pros. Den. 6:80 Jan. 1956.

approximately equal to the gelation time. This conversion from sol to gel by changing the soluble alginate to an insoluble one is a chemical reaction that has been explained more completely by Schoonover and Dickson.[5]

The gelation time is dependent on the amount of retarder and the temperature of the mix. For example, a 10° C. (18° F.) decrease in temperature will approximately double the gelation time. The temperatures of the mixing equipment, water, and alginate, as well as the temperature of the room where the material is mixed will all have a considerable effect on the temperature of the mix and the gelation time.

When alginate powder is prematurely exposed to the atmosphere, moisture can be absorbed which will effectively reduce the amount of retarder present. This will reduce the gelation time. Therefore, the use of the metal foil envelope units of alginate is strongly recommended because of the complete protection from moisture.

The major constituent of an alginate impression is water. After an alginate has gelled, it starts losing water and shrinks when allowed to remain in air. A second factor resulting in distortion is the release of internal strain during storage. It is most important to pour the model immediately after taking the impression. This should be done in the dental office.

The dental laboratory questionnaire mentioned earlier was sent to six representative laboratories in different geographical sections of the country. The results showed that of the alginate and agar impressions taken for removable dentures, about 70 per cent were alginate. Also, it was found that about 3.5 per cent remakes were required from alginate impressions and only one half to one quarter as many remakes were needed from agar impressions. The percentage of remakes tended to be higher in the summer when temperatures were higher.

PROCEDURE FOR USE WITH ALGINATE

The following procedure is based on a general knowledge of the chemistry and physics of the alginates, data and suggestions received from the dental laboratory questionnaire, and information obtained from many members of the dental profession.

The teeth should be cleaned, the mouth rinsed thoroughly and the area under consideration dried just before taking the impression.

When an occasional impression is made, it is better to use the individual metal foil units since the foil envelope protects the alginates from changes in moisture content and atmospheric conditions.

In mixing the alginate, the manufacturer's directions should be followed carefully. It is important to use the recommended amounts of water and alginate powder and to spatulate vigorously to a smooth mix in the time recommended by the manufacturers, usually one minute. During hot weather the equipment (bowl and spatula) should be precooled, especially when small amounts of impression material are mixed. Cool water is necessary to slow the reaction. The temperature of the mixing water should be 70° F. or less, and should be routinely determined with a thermometer. Also, it is well to check the temperature of the fresh unset mix in order to be sure the mix is cool (70° F. or less). By using a cool mix, premature setting of the alginate may be avoided.

After precoating the important areas with alginate to avoid trapping air bubbles, and bringing the filled tray to place, the time of set should be determined by testing the excess material remaining in the mixing bowl for loss of

5. Schoonover, I. C., and Dickson, G. Preparation and characteristics of elastic dental impression compounds with an alginate base. J.A.D.A. 30:565 April 1943.

tackiness. The impression should be removed two minutes after this observed gelation time with a sudden jerk or snap. To tease gradually or to rock the alginate impression back and forth in the mouth may cause permanent distortion.

After removal, the impression should be rinsed gently with water if necessary, and then the excess surface water removed with a gentle blast of air and finally dried with paper tissue. Care must be taken to avoid any undue dehydration. The model must be poured instantly. Any delay will probably mean a loss of water from the impression and result in a permanent distortion. The most frequent error in the use of alginates occurs in delay in pouring the model. The only safe system is to pour immediately. Morrant and Elphicke[6] have found that liquid paraffin B. P. (white mineral oil) is the most satisfactory medium for storing alginates. They found no visible distortion in casts from impressions that had been stored up to 48 hours. This may be a possible solution to storing wet alginate impressions. The mix of plaster or stone can be started by an assistant while the impression is being rinsed and dried. The surest method of obtaining unsatisfactory results is to send the wet impression to the dental laboratory for pouring of the model.

The poured cast and impression are covered with wet paper toweling or are placed in a humidor at 100 per cent humidity to prevent drying of the alginate while the stone is setting. The impression and cast are separated one hour after the cast is poured, otherwise the surface of the cast may be damaged.

CONCLUSION

For those who make an occasional impression it is better to use the metal foil single unit package of alginate which is well protected from atmospheric moisture.

Mixes should result in a smooth creamy mass.

Precooling the mixing equipment and using cool water is indicated to delay setting time. Since this is a chemical reaction the working time will be lengthened by a reduction in temperature.

The impression should be removed with a sudden jerk about two or three minutes after time of set.

Impressions should be poured instantly and covered with wet paper towels immediately. The poured impressions may be placed in water after initial set of the stone if desired.

Impressions and casts should be separated one hour after pouring.

Excellent accuracy can be obtained with alginates when the material is used properly.

6. Morrant, G. A., and Elphicke, G. B. An investigation into methods for maintaining the dimensional stability of alginate impression material. Brit. D. J. 100:42 Jan. 17, 1956.

BUREAU OF ECONOMIC RESEARCH AND STATISTICS

The 1956 survey of dental practice
VI. The dentist's work week and work year; certain office practices

It is a well known fact that most dentists are busy and work long hours. Statistics on length of work week by region and specialty provide evidence regarding the relative need for more dentists in the various regions and specialties.

THE WORK WEEK

Respondents were asked to record the days of the week, other than Sunday, they ordinarily closed their offices (Tables 34 and 35). Only 2.9 per cent of all non-salaried dentists said they worked six full days per week. This figure varied from 2.1 per cent in the Southeast to 7.7 per cent in the Northwest.

The most common practice, reported by 34.3 per cent, was to take one whole day off. Nationally, Wednesday was the favorite day off (11.5 per cent), followed by Saturday (8.7 per cent) and Thursday (8.4 per cent). Only two of every thousand dentists reported taking all day Tuesday off (and no other day).

The choice of a whole day off varied considerably according to region. In the Southeast, Thursday was the favorite day off, whereas in the Far West, Southwest and Northwest it was Saturday. In the Middle East, Friday was almost as popular as Wednesday as a day off.

Nearly 16 per cent of the respondents took two half days off, and in almost all instances the two half days were the afternoons of either Saturday and Wednesday or Saturday and Thursday. The practice of taking two half days off was especially common in the Southwest (31.2 per cent).

Eighteen per cent of the respondents worked five and one half days per week. This practice was reported most frequently in the Northwest, where 35.3 per cent of the dentists took only a half day off.

Almost all of the dentists who worked five and one half days took an afternoon rather than a morning off. The most popular afternoon off was Saturday (7.1 per cent) followed by Wednesday (4.6 per cent) and Thursday (4.3 per cent).

One of every six dentists took one and one half days off per week. In the Far West this practice was followed by one of every four dentists.

One of every 12 dentists closed his office two full days per week. The combination of days chosen most frequently was Saturday and Wednesday.

The average number of days worked per week was 4.9 (Table 35). This average did not vary greatly from region to region. Lowest average (4.8 days) was reported in New England and the Far West, and highest average (5.1 days) in the Northwest.

The mean number of office hours per week was 43.2 in 1955, almost identical to the figure of 43.3 hours found in the survey covering 1952. As shown in Table 36, 21.8 per cent of the dentists reported 50 or more office hours per week.

The typical dentist spent 35.3 hours per week at the chair, 4.1 hours in the laboratory and 3.8 hours in other office

The first five articles in this series appeared in The Journal for November and December 1956 and January, February and March 1957.

Table 34 • Percentage distribution of independent dentists according to days or half days off from practice in 1955, by region

Days or half days off	New England	Middle East	South-east	South-west	Central	North-west	Far West	United States
No days off	4.0	2.6	2.1	2.3	2.5	7.7	2.4	2.9
One half day off	16.3	11.3	20.3	21.3	22.0	35.3	10.8	18.0
Morning	1.6	.4	.3	2.6	.5	1.1	.2	.6
Afternoon	13.2	10.4	19.7	18.7	20.9	32.3	10.1	16.7
Wednesday	4.6	2.6	7.6	3.6	6.2	4.1	3.2	4.6
Thursday	1.2	2.4	5.5	3.6	7.2	6.8	1.3	4.3
Friday	.3	1.1	.5	1.6	.1	.0	.5	.6
Saturday	7.1	4.3	5.5	9.9	7.3	21.4	5.0	7.1
Other days	.0	.0	.6	.0	.1	.0	.1	.1
Undesignated	1.5	.5	.3	.0	.7	1.9	.4	.7
Two half days off	15.7	12.1	20.1	31.2	15.2	15.1	14.0	15.8
Saturday and Wednesday afternoons	11.7	8.0	13.2	16.1	9.2	9.3	8.8	9.9
Saturday and Thursday afternoons	2.8	3.0	6.4	14.1	4.9	4.9	2.6	4.7
Other combinations of two afternoons	.3	.7	.3	.7	.6	.3	.5	.5
Combination of one afternoon and one morning	.9	.4	.2	.3	.5	.3	2.0	.6
Combination of two mornings	.0	.0	.0	.0	.0	.3	.1	.1
Three half days off	.6	.2	.0	.3	.1	.0	.1	.2
One whole day off	34.2	39.0	33.5	22.3	36.2	26.1	32.1	34.3
Monday	4.9	.7	1.1	1.6	1.1	3.3	6.1	2.2
Tuesday	.6	.2	.2	.0	.2	.3	.1	.2
Wednesday	16.3	12.2	9.7	3.9	17.5	4.4	4.7	11.5
Thursday	5.2	8.0	13.4	3.0	11.6	7.7	2.8	8.4
Friday	1.6	11.9	.2	.3	.6	.0	.3	3.3
Saturday	5.6	6.0	8.9	13.5	5.2	10.4	18.1	8.7
Two half days or one whole day, day of week uncertain	2.8	3.0	3.1	1.3	2.1	.8	2.9	2.5
One whole day and one half day off	17.8	18.9	13.4	14.1	13.5	9.3	24.6	16.5
All day Wednesday plus one other half day	10.8	7.5	5.0	3.3	7.4	2.2	6.6	6.6
All day Friday plus one other half day	.9	3.5	.0	.0	.1	.0	.0	.9
All day Saturday plus one other half day	2.1	2.7	4.0	4.9	1.4	3.8	10.9	3.9
Other combinations	4.0	5.2	4.4	5.9	4.6	3.3	7.1	5.1
Two days off	7.4	10.6	6.8	6.2	7.8	5.2	11.0	8.5
All day Saturday and all day Wednesday	4.3	4.7	2.8	3.6	4.8	2.7	6.9	4.6
All day Saturday and all day Thursday	.3	1.9	2.8	2.0	1.5	1.1	2.0	1.8
All day Wednesday plus one other day except Saturday	1.2	1.4	.4	.0	.5	.0	.3	.6
Other combinations	1.6	2.6	.8	.6	1.0	1.4	1.8	1.5
More than two days off	1.2	2.3	.7	1.0	.6	.5	2.1	1.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 35 • Percentage distribution of independent dentists according to number of days worked per week, by region

Number of days worked	New England	Middle East	South-east	South-west	Central	North-west	Far West	United States
6	4.0	2.6	2.1	2.3	2.5	7.7	2.4	2.9
5½	16.3	11.3	20.3	21.3	22.0	35.3	10.8	18.0
5	52.7	54.1	56.7	54.8	53.5	42.0	49.0	52.6
4½	18.4	19.1	13.4	14.4	13.6	9.3	24.7	16.7
4	7.4	10.6	6.8	6.2	7.8	5.2	11.0	8.5
Less than 4	1.2	2.3	.7	1.0	.6	.5	2.1	1.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	4.9	4.8	5.0	5.0	5.0	5.1	4.8	4.9

Table 36 • Percentage distribution of independent dentists by number of office hours per week in 1955

Number of hours	Per cent of dentists	Cumulative per cent
–29	3.8	3.8
30–34	7.2	11.0
35–39	17.0	28.0
40–44	31.2	59.2
45–49	19.0	78.2
50–54	12.7	90.9
55–59	4.6	95.5
60–	4.5	100.0

Table 37 • Mean number of office hours of independent dentists per week in 1955, by type of practice and type of office activity

Type of activity	General practi-tioner	Specialist	Oral surgeon	Ortho-dontist	Pedo-dontist	Perio-dontist	Prostho-dontist	All types of practice
Chairside	35.6	30.7	30.2	31.4	34.4	31.5	22.8	35.3
Laboratory	4.1	4.0	.3	6.0	2.2	.8	9.7	4.1
Other hours in office	3.7	4.8	7.4	3.9	3.4	4.0	4.3	3.8
Total	43.4	39.5	37.9	41.3	40.0	36.3	36.8	43.2

activities (Table 37). These figures varied considerably by type of practice. Dentists in each specialty averaged fewer office hours per week than general practitioners. Prosthodontists and orthodontists, of course, spent a greater than average amount of time in the laboratory. The average for "other hours in office" was highest for the oral surgeons.

The average dentist worked 43.2 hours or 4.9 days per week. Dividing, it is estimated that the average dentist worked 8.8 hours per day in the office.

THE WORK YEAR

The mean number of weeks worked in 1955, according to type of practice, is shown in Table 38. The mean was 47.2 weeks and did not vary much with type of practice except that prosthodontists (44.9 weeks) tended to work about two weeks less than most other dentists.

Multiplying the mean number of hours in the office per week by the mean number of weeks worked indicates that the average dentist spent 2,039 hours in his

Table 38 • Average number of weeks worked in dental office by independent dentists in 1955, by type of practice

Type of practice	Number of weeks worked	
	Mean	Median
General practitioner	47.2	48
Specialist	47.1	48
Oral surgeon	47.5	48
Orthodontist	47.5	48
Pedodontist	46.6	48
Periodontist	46.2	48
Prosthodontist	44.9	46
All independent dentists	47.2	48

Table 39 • Percentage of independent dentists using a general anesthetic of any kind in their offices, by region

Region	Per cent
New England	30.4
Middle East	18.3
Southeast	12.3
Southwest	15.2
Central	12.7
Northwest	16.3
Far West	11.9
United States	15.4

Table 40 • Percentage of independent dentists who wrote one or more prescriptions for drugs within preceding six months, and mean number of prescriptions written, by region

Region	Per cent writing prescriptions	Mean number of prescriptions written	
		By all independent dentists	By dentists writing prescriptions
New England	84.7	51.5	62.0
Middle East	85.8	45.5	53.4
Southeast	91.3	104.9	116.4
Southwest	90.3	130.7	147.3
Central	81.1	50.7	63.7
Northwest	86.4	75.3	88.0
Far West	85.9	62.9	73.4
United States	85.4	64.2	76.1

office during 1955, of which about 1,666 hours were at the chair.

Dividing income by number of hours worked during the year shows that the typical nonsalaried dentist averaged a gross income of $10.84 per hour in the office or $13.26 per hour at the chair. He averaged a net income of $6.12 per hour in the office or $7.49 per hour at the chair.

CERTAIN OFFICE PRACTICES

Independent dentists participating in the survey were asked to indicate whether a general anesthetic of any kind was used in their offices. As shown in Table 39, 15.4 per cent answered "yes." In 1952, 16.4 per cent of the independent dentists stated they "had equipment" for administering gas in their offices.

The percentage of dentists using a general anesthetic in 1956 was almost three times as high in New England (30.4 per cent) as in the Far West (11.9 per cent).

The large majority of dentists reported that they had written prescriptions for drugs during the six months preceding receipt of the questionnaire (Table 40). Nationally, 85.4 per cent of the independent dentists had written prescriptions during the period. This figure did not vary much by region but did tend to be a little higher in the Southeast and Southwest than in other regions.

Table 41 • Percentage of independent dentists having a license for prescribing narcotics, by region

Region	Per cent
New England	68.1
Middle East	60.7
Southeast	81.0
Southwest	75.7
Central	51.0
Northwest	61.6
Far West	63.8
United States	62.2

There was, however, a large difference in the number of prescriptions for drugs written during the six-month period in the various regions. The Southwest and Southeast were high with averages of 147.3 and 116.4 for dentists who had written prescriptions. At the other extreme was the Middle East, where the average was 53.4 prescriptions per dentist.

About six of every ten nonsalaried dentists owned a license for prescribing narcotics (Table 41). The percentage was lowest in the Central region (51.0 per cent) and highest in the Southeast (81.0 per cent).

The next article in this series will present information on the number of patients treated by dentists during the course of a year.

The Spirit of Man • Any doctor who is moderately active sees, in the course of a year, at least a couple of thousand people in his office. In almost eighteen years of practice I have had a good many people sit alongside my desk and tell me of their illnesses, anxieties and often personal tragedies. From this store of experience I have learned at least one basic truth; namely, that every man, woman and child on this earth, regardless of their station of life, regardless of their racial origin, and regardless even whether they are moral or unmoral according to accepted standards, is worthy of and should be treated with respect, as befits the essential dignity of man.

The human body is the most ingeniously contrived mechanism and the most beautiful structure on earth. Every bone is a masterpiece of architectural design. Every human organ is a marvel of efficiency which no engineer can equal. The smallest gland is a chemical plant that outperforms the greatest man-made laboratory in the world. If all the volumes of medical literature were gathered together they would fill to overflowing the greatest of skyscrapers—and yet we have just scratched the surface of what there is to know about the human body. Over and above this complex perfection, man has something more. There is a nonmechanical and nonmaterial element in him that is not found in any other form of life that we know. We cannot see it and cannot even begin to understand it, but it is there and it raises man to a dignity above the brute.

In a small way a doctor shares the lives of a great many people. He knows their troubles, worries with them, does his best to make them well and happy and is glad with them when he succeeds. A good doctor is, within the limits of his own field, the servant of the humblest individual, the patient who needs his services. I cannot say that I have liked every single man or woman I have met—though I have liked most of them—but liking has nothing to do with respect. There are people who have become hypocrites, liars, thieves and murderers—just the same, they are human beings. I admit that I cannot help hating such people at times, but it doesn't last. Hatred cannot last unless it is continuously nourished and stimulated.

I believe in God and that He made the earth and set it to spinning and circling around the sun. I know too that the spinning earth is not intended to turn forever. Little by little it is slowing down. A day will come, perhaps a million years from now, when it will no longer turn and everything will be still. Long before that happens all the races of man will have disappeared from the face of the earth, and with man also all the things he has made—his cities and roads, his machines and books. But even when the last sound made by the last living creature has died away and the cold silence of eternity has settled upon this planet, I believe that somehow the spirit of man will live.—***Edmund A. Brasset, The Invisible Medicine of Humanity.***

Book Reviews

INTRODUCTORY PSYCHOSOMATIC DENTISTRY

By John H. Manhold, Jr., D.M.D., M.A. 193 pages with illustrations. Index. $5. New York, Appleton-Century-Crofts, Inc., 1956.

In a limited sense, a psychosomatic disorder is one that can be analyzed and understood only when psychological as well as physiological factors are taken into consideration.

This book has been written for a twofold purpose. The first is to provide an empirical basis for the application of the psychosomatic concept to dentistry. The second is to deal with the practical applications of this concept. Methods for dealing with difficult patients and situations, commonly encountered by the practicing dentist, are emphasized. The author stresses the fact that psychosomatics is not, as is so often implied in the dental literature today, synonymous with, or even necessarily related to, hypnotism.

The text is divided into two parts. Part one, the psychosomatic concept, contains information on the historical background of psychosomatics, statistical methods, and research results. Part two, practical applications, applies the psychosomatic concept to dental problems.

The book attains sufficient depth to appeal to the practicing dentist as a reference work and, at the same time, serves satisfactorily as a text for classroom work. There is an abundance of design data, fundamental mathematical development and physical explanation. An occasional illustrative problem is included. Each section is extensively documented by references to the literature.

E. Alan Lieban

THE OFFICE ASSISTANT IN MEDICAL OR DENTAL PRACTICE

By Portia M. Frederick and Carol Towner. 351 pages with 55 illustrations. Index. Appendix. $4.75. Philadelphia, W. B. Saunders Co., 1956.

Portia M. Frederick, instructor in medical office assisting at Long Beach City College, and Carol Towner, executive assistant, department of public relations, American Medical Association, have collaborated to produce a book that is recommended reading. It will prove of use to the experienced assistant as well as to the novice.

The 26 chapters, divided into two sections, provide a blueprint of office assisting. The first section concentrates on the business and secretarial aspects, discussing ethics, reception room and telephone technics, doctor-patient-assistant relationships, appointments, records, fees, credit and collecting, bookkeeping, banking and insurance problems.

The second section deals with the medical-dental aspects of assisting and discusses examinations, sterilization technics and care of instruments, pharmacology, medications and injections, immunology, therapy, care and ordering of medical and dental supplies, medical and dental reading matter, professional and health organizations and planning of the office routine.

The authors stress the advantages of a career in medicine or dentistry, the part the assistant plays in the continuing and never-ending battle of medical men to defeat illness and prolong life, and the reliance that the doctor places on the accuracy and dependability of his assistant. The doctor relies on his assistant far more than the businessman does on his secretary, the book points out. "Dollars and cents are at stake in the business world, but health and lives are at stake in the medical world," it declares.

The appendixes contain suggested reading and common abbreviations and symbols.

Sadie M. Leach

GROUP DISCUSSION-DECISION: AN APPRAISAL OF ITS USE IN HEALTH EDUCATION

By Betty Wells Bond. 109 pages. Appendix. Limited distribution. Minneapolis, Minnesota Department of Health, 1956.

Every dentist is, or should be, interested in motivation. How can the public be induced to adopt desirable dental health practices? He should, quoting the author in her manual *Group Discussion-Decision*, "share in the evaluation of philosophies and the determination of concepts and technics related to health." This manual is devoted to the study of group behavior conducted by the author and presents interpretations and implications of her investigation.

The effectiveness of the lecture method was compared with the effectiveness of the group discussion-decision method in a health education program concerned with a particular chronic illness—breast cancer. Which method could best be relied on to obtain a breast examination by a physician, to influence women to practice monthly breast self-examination and to induce women to demonstrate to a physician their testing of breast self-examination?

The author described the statistical methods used to obtain valid evidence of the value of the group discussion-decision method. The reader will be rewarded by her review of mass media, mass informational methods and group discussions in changing attitudes.

Of course, the most significant purpose of the book is the explanation of group discussion-decision and the presentation of proof indicating the value of this method.

Group discussion as envisaged in this present study was intended to go beyond the recognition of various points of view to the recognition that many of the problems faced in the area to be discussed were common problems, that the worries and fears, whether rational or not, were shared.

After discussion sessions, the experimental groups proceeded to make a decision in regard to actions suggested as helpful in solving the problem discussed. The discussion team without decision was less effective than a similar team where decision followed the discussion.

Bond has substantiated previous observations of others that lectures are comparatively ineffective in motivating people unless audience participation is stimulated.

J. M. Wisan

CLINICAL ENDODONTICS

By Ralph Frederick Sommer, D.D.S., M.S.; F. Darl Ostrander, D.D.S., M.S., and Mary C. Crowley, M.S.P.H. 514 pages with 384 illustrations. Index. $10.50. Philadelphia, W. B. Saunders Co., 1956.

This book was intended to serve as a visual teaching aid and a practical reference guide to dental students, general practitioners and dental teachers.

The 22 chapters, written in an informal style, are illustrated profusely. Included is an extensive folio of roentgenographic reproductions and photomicrographs. A bibliography is appended to some chapters.

Although the book on the whole is scientifically sound and its good points should help promote a better understanding of endodontics, a number of errors must be pointed out and a number of criticisms made.

In the chapter on the history of root canal therapy, the authors state, "It was not, however, until an aseptic technic was introduced (Sommer and Crowley, 1940; Morse and Yates, 1941), that all possibility of culturing the normal oral flora could be eliminated and that endodontics based on scientific methods gained acceptance." Further, "The introduction of an aseptic technic of culturing and treating root canals made it possible to determine infection and not the presence of microorganisms. . . . And far more important the presence of a sterile root canal and elimination of infection could be determined scientifically."

Such presumptuousness cannot go unchallenged. Outstanding work of other scientific confreres in this field antedated Sommers and Crowley. These earlier authorities certainly practiced endodontics at least on the same scientific level as the authors.

After a chapter on rubber dam technic for endodontics, the authors describe hazards involved in the use of short-handled instruments. They say, "Because of the very small handles on these instruments, the operator is constantly confronted with the possibility of having an instrument slip and be swallowed." How is it possible for an instrument to be swallowed if the rubber dam has been applied previously? Furthermore, short instruments enhance the tactile sense and are definitely advantageous.

On page 225, "Preparation of Canal to Determine Bacteriologic Status," the reader is instructed to "place rubber dam markers on long-handle file No. 1, 2, 3. (Use short-handled files in bicuspids, molars and mandibular anteriors.)" This last statement certainly contradicts the previous one.

On page 281 one finds: "If the instrument is broken in the apical third of the canal in anterior teeth it is possible to remove it by resecting the root and removing it from the apical end." If such a procedure can be accomplished it is a feat, in view of the fact that most instruments taper.

One reads on page 466: "Unlike some earlier bleaching technics, the use of pyrozone or superoxol and light for bleaching does not increase the brittleness of tooth structure." Despite this statement, bleaching causes further dehydration which increases brittleness.

The average practitioner is interested primarily in fundamentals. Unfortunately, the authors have not presented the material wholly realistically nor with complete clarity. The book is poorly organized, frequently repetitious, usually verbose in the explanation of minor details and almost invariably telegraphic in areas warranting more complete discussion.

The illustrations are plentiful and unusually good. The publishers are to be congratulated on the good cuts, the clarity of type, the quality of paper and the excellency of the binding.

E. Alan Lieban

METODICA ICONOGRAFICA DI MORFOLOGIA DENTALE UMANA (METHODIC AND DIAGRAMMATIC PRESENTATION OF THE MORPHOLOGY OF HUMAN TEETH)

By Prof. Siro Taviani. 120 pages with 174 illustrations. Appendix. Cagliari, Italy, Editio dell'istituto di Antropologia dell' Universita, 1956.

When in 1924, the author, who is now head of the dental clinic of the University of Perugia, began his studies for this work, hardly any other researcher had dealt systematically with the morphology of human teeth. As a matter of fact, all previous publications had been aimed almost exclusively at ascertaining the origin instead of the underlying cause for the development of the present form of human teeth.

Only the discovery of then unknown factors could explain the reason for the wide variety and variability in form and size of human teeth observable even in teeth which have the same function and are in the same mouth.

The author intends to demonstrate the morphologic features of human teeth and their functional significance. The book is limited to an explanation of the accompanying excellent photographs, roentgenograms and diagrams; the individual reader may form his own conclusions. The captions to the illustrations aim to present the proper manner for efficient morphologic investigation.

The author's previous books, although written in the Italian language, have been accepted throughout the world as standards by which other textbooks may be judged. This new work, the first of a series, printed on excellent quality glossy paper, continues the tradition of excellence. An English translation should be offered soon.

The scholarly standing of the author and the high professional reputation of the publisher make it safe to assume that the succeeding section of the series will maintain the standard set by the first section.

The book is written in an easily comprehensible Italian; it should prove a useful guide to dentists interested in its subject.

Paul H. Glucksman

BOOKS RECEIVED BUT NOT REVIEWED

NATIONAL LIBRARY OF MEDICINE CLASSIFICATION • Prepared by the Armed Forces Medical Library, ed. 2. 314 pages. $2. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., 1956.

HANDBOOK OF PEDIATRIC MEDICAL EMERGENCIES • By Adolph G. DeSanctis, M.D., ed. 2. 389 pages with 73 illustrations. $6.25. The C. V. Mosby Co., 3207 Washington Blvd., St. Louis, 1956.

HOME HEALTH EMERGENCIES • By the Medical Department, The Equitable Life Assurance Society of the United States. (Book based on original manuscript by Granville W. Larimore, M.D., M.P.H.) 256 pages with illustrations. Equitable Life Assurance Society of the United States, 393 Seventh Ave., New York, 1956.

SPORTS INJURIES MANUAL FOR TRAINERS AND COACHES • By Donald F. Featherstone. 132 pages with illustrations. $6. Philosophical Library, Inc., 15 E. 40th St., New York, 1956.

MENTAL DISORDERS IN LATER LIFE • By Oscar J. Kaplan, editor, ed. 2. 508 pages with illustrations. $7.50. Stanford University Press, Stanford, Calif., 1956.

DICTIONARY OF POISONS • By Ibert Mellan and Eleanor Mellan. 150 pages. $4.75. Philosophical Library, 15 E. 40th St., New York, 1956.

GUIDES TO ACTION ON CHRONIC ILLNESS—TODAY, TOMORROW, TOGETHER • 1956 National Health Forum conducted by the National Health Council, March 21 and 22, New York City. 88 pages with illustrations. $1. National Health Council, 1790 Broadway, New York, 1956.

SLEEP • By Marie Carmichael Stopes, Ph.D. 154 pages. $3. Philosophical Library, Inc., 15 E. 40th St., New York, 1956.

THE OLD FARMER'S ALMANAC, 1957 • By Robert B. Thomas. 112 pages with illustrations. Yankee, Inc., Dublin, N. H., 1956.

CARIES CONTROL PROCEDURES • By the University of Pennsylvania. (Compiled by Robert E. De Revere, D.D.S.) 37 pages. Caries Control Laboratory, School of Dentistry, University of Pennsylvania, 4001 Spruce St., Philadelphia, 1956.

Current Literature

TREATMENT OF THE ACUTE ALVEOLAR ABSCESS

Howard L. Wolfsohn. New York D.J. 22:449 Nov. 1956.

A rapid, effective method of treating early acute alveolar abscesses and acute exacerbations of chronic abscesses has been developed.

Clinically, the acute alveolar abscess leads to a pericementitis with slight pain on percussion. This is followed by throbbing, which gradually intensifies until there is extreme discomfort on percussion. The tooth may extrude slightly and become slightly mobile. As a path of least resistance is found in the bone, a swelling may start in the adjacent soft tissues. The swelling progresses and may become grotesquely noticeable extraorally. The swelling is accompanied by fever and malaise when systemic involvement occurs. Frequently, the pain diminishes noticeably as the swelling increases in size. Unless the obvious pathology is an acute exacerbation of a chronic abscess, roentgenograms may show no periapical rarefaction at this stage.

The involved tooth may be differentiated by clinical examination consisting of roentgenographic or objective evidence of deep caries or percussion and palpation of the teeth in the region.

Before frank swelling occurs, the acute alveolar abscess may resemble an acute apical periodontitis, only it will be far more severe. To rule out the latter condition, the pulp chamber is opened to determine whether relief of pain may be obtained. If there is relief, the condition is probably periodontitis, and no further palliative treatment is necessary. If there is no relief, an artificial sinus tract must be produced. The patient should be premedicated preferably with penicillin, to minimize bacteremia or the spread of infection.

An acute apical periodontitis must be ruled out first by opening the root canal. Once this is done the region is completely anesthetized and a semilunar incision is made near the apex of the tooth. A mucoperiosteal flap is reflected, and a hole is drilled through the cortical layer of bone at the region of the root apex, by means of a bone bur or a large round bur. When the region of infection is reached, the bur encounters no resistance and drops into the space. At this time, the patient may experience a quick stab of pain. In the event an acutely exacerbated chronic abscess is diagnosed, the region can be curetted. The flap is replaced and sutured loosely. The root canal can be left open or may be reamed at this time and a medicament sealed within.

The patient is given postoperative instructions which include the use of heat packs or an infrared lamp for 20 minutes every two to three hours for a prescribed length of time, and hot saline rinses. The patient should be prepared to expect some swelling. The sutures can be removed in five to seven days, after which endodontic therapy is undertaken. A roentgenogram taken a week or so after the first operation usually will show a small radiolucent area at the region of the root apex, if it is an instance of acute alveolar abscess. The radiolucent area should disappear in several months. This method of treatment also may be used to alleviate the severe pain of persistent acute apical periodontitis.

RECRUITMENT TO THE DENTAL PROFESSION

Brit. M.J. No. 4997:153 Oct. 13, 1956.

The committee on recruitment to the dental profession, set up in England in 1955 under the leadership of Lord McNair, has made its report. There is little prospect of any increased entry into the dental profession during the next few years to balance the retirement of the many dentists of advanced age now on the Register. The numbers entering the dental schools during the last five years dropped to the lowest point yet, and even if recruitment is stimulated at once there is no hope of a substantial increase for at least eight years.

The dental profession is failing to attract recruits for three main reasons. The public does not understand the true import of dental health, and too little is known of the possibilities of dentistry as a career; many dentists are unwilling to advocate it; parents cannot afford the outlay for training for a profession which is not as attractive as it could be.

If appropriate steps are taken to remedy these things, young people will offer themselves in sufficient numbers as recruits. To achieve the aim of increasing the Register to 20,000, an annual intake of about 900 will be needed, compared with about the 550 presently added to the Register each year. A difficulty would be to increase the accommodation in dental schools in sufficient time. Universities should at once consider how they

can provide additional places in the preclinical year. The possibility of developing the facilities of dental departments in general hospitals for clinical training also should be considered.

The establishment of an independent and representative standing committee to secure public awareness of dental matters is recommended. Women should be encouraged to enter the profession.

So far as possible, the causes of the dentist's present discontent with his profession should be removed. The system of remuneration should be reviewed. Consideration should be given to correcting the present pattern of earnings whereby the dentist's income tends to diminish in middle age, regardless of increasing experience. The financial problems facing dentists on retirement should be eased. Methods should be examined whereby help can be made available to suitable candidates for dental schools whose parents cannot afford the necessary contribution. The list of treatments set out in the National Health Service Regulations as requiring prior approval should be reviewed. Any treatment which could be an occasion or a source of abuse by either patient or dentist should be removed. The number of dental consultant posts should be increased, as should facilities for dental research.

GAGGING AS RELATED TO PROSTHETIC DENTISTRY

Ralph C. Appleby and H. J. Day. J. Florida D. Soc. 27:19 Oct. 1956.

The swallowing reflex is caused by stimulation of the afferent nerve fibers of the fifth, ninth and tenth cranial nerves. The receptor endings of these fibers are found in several sensitive areas of the fauces, the soft palate, the posterior third of the tongue and the posterior pharyngeal wall. Gagging may follow stimulation of any of the same receptor endings and will produce the same muscular movements, but in an uncoordinated and spasmodic manner.

When an impression of the mouth is taken, a topical anesthetic may be applied to the sensitive areas of the mouth that trigger the gagging reflex. The dentist should try not to stimulate more than one sensitive area at a time. He should prevent an excess of impression material from flowing back on the soft palate and down on the tongue, and should prevent excess saliva from gathering in the mouth by having the patient sit upright or perhaps lean forward. Impression material should be removed from the mouth as soon as possible. The patient should be instructed to breathe deeply through the nose or mouth while the impression material is in the mouth.

Several technics to combat gagging have been proposed, including the following:

1. Dressen (1947) asserts that the apprehensive patient usually can be controlled by education, an explanation of what is being done, and care and patience in inserting the trays and impression materials. The patient with no evident control over the gagging reflex can be helped by the administration of 1.5 to 2 grains pentobarbital (Nembutal C which contains aspirin also) 30 to 45 minutes prior to impression taking.

2. Feintuch (1954) constructs an acrylic baseplate to the outline of the finished denture and instructs the patient to take the baseplate home and try to seat it; when it can be tolerated, the patient returns for final impression.

3. Stephens (1949) asks the patient to come with an empty stomach early in the day, when unexcited and rested.

4. A patient can be trained to tolerate sensation of the palate and throat by being directed to stand in front of a mirror and observe as he massages the soft palate and posterior wall of his throat.

5. The placing of salt on the tongue of the patient prone to gag has been found to be helpful. The placing of a liberal amount of salt in the palatal area of the denture before insertion helps some patients to tolerate their dentures.

6. Mintz (1951) has used hypnosis successfully in treating the gagging patient who could not tolerate the placement of a complete denture in the mouth.

7. Leslie (1940) proposes a surgical operation for indicated instances, after all other methods have failed to relieve the gagging. The operation leads to a shortening and tightening of a lax, atonic soft palate, and to a shortening of a long uvula.

MANAGEMENT OF TUMORS OF INFERIOR ALVEOLAR PROCESS AND MANDIBLE

John J. Conley. J. Oral Surg. 14:325 Oct. 1956.

Immediate bone grafting should be considered in all resections of the mandible where a section of alveolar process and mandible and suprahyoid or lateral neck contents are removed in continuity. The limiting factors are the quality of the tissue bed and the size of the dead space created. Immediate bone grafting is not justified in intensely irradiated tissue

beds. Neither is it warranted when there has been an extensive excision including half of the tongue, floor of the mouth, buccal and alveolar sulci and a portion of the cheek along with the lateral neck contents. In this latter instance, the extensive amount of tissue lost precludes the implantation of a bone graft. Further care should be given to the preservation of the ascending ramus of the mandible, which is rarely involved in the cancerous process, so that it may be used either immediately or at a later date in the bone grafting technic. The routine excision of this uninvolved portion of the mandible is to be condemned.

The incidence of successful "take" of the free bone graft in Class I cancer is 90 per cent and in selected cases of excision of the mandible, floor of mouth and neck (Class II) is approximately 70 per cent.

The internal fixation of the bone graft with a special Vitallium plate and screws with or without the assistance of maxillary wiring has the advantages of immediate, absolute fixation in the mandibular arch, shortened hospital stay and morbidity period, a limited return of function of the mandible within two weeks and a minimal amount of inconvenience to the patient.

JUNCTIONAL NEVUS OF THE PALATE

C. Dean Couch, Jr. J. Oral Surg. 14:334 Oct. 1956.

The infrequency of occurrence of a nevus within the oral cavity is evident from the paucity of case reports. The etiology of nevi has been a controversial subject since 1900. It was first suggested that they are of epithelial origin. However, as spindle cells were noted in some of them, which suggests relation to connective tissue, they were placed in the classification of sarcomas. The latest theory is that they may be of neuroblastic origin.

Nevi are divided into several groups histologically; however, the junctional type (those at the dermoepidermal border) is the most dangerous since it is more prone to become malignant. Histologically, junctional nevi are characterized by collections of clear, rounded or polyhedral nevus cells situated partly in the epidermis and partly in the dermis. These nevus cells are closely packed, and there are only a few deeply pigmented cells which tend to lie at the periphery of the cell cluster. The amount of pigment varies greatly and bears no relation to possible malignancy.

Any circumscribed pigmented growth situated in the mouth which is clinically suspected of being a nevus should be surgically excised, particularly if it is situated in a region which is subjected to daily trauma. It is well to consider all solitary pigmented nevi as premalignant and to treat them as such.

A 50 year old woman came for treatment of a nevus approximately 1 cm. in diameter which had been present in the hard palate for four years. The lesion had been asymptomatic except for gradual increase in size. The lesion was excised under general anesthesia, and the postoperative course was uneventful.

STAPHYLOCOCCUS ENTERITIS AS A CONSEQUENCE OF ANTIBIOTIC TREATMENT: REPORT OF TWO CASES (STAFILOKOKNI ENTERIT KAO POSLJEDICA TERAPIJE ANTIBIOTICIMA)

Petar Smirčič. Vojnosan. Pregled, Belgrade 13:355 July-Aug. 1956.

Two instances of staphylococcus enteritis resulting from antibiotic treatment administered during oral surgery were observed at the Military Hospital in Belgrade, Yugoslavia.

Case 1. The patient, a 21 year old soldier, received intramuscularly 250,000 units of crystalline penicillin combined with 650,000 units of procaine penicillin. The clinical picture, two days after penicillin administration, revealed the following symptoms: rapid rise of temperature, diarrhea and massive collapse (choleriform syndrome).

Case 2. The patient, a 27 year old soldier, received 250 mg. of chlortetracycline hydrochloride mixed with milk four times daily together with his meals. The clinical picture was identical with that in Case 1.

The administration of the antibiotics, previously used, was stopped immediately, and a combination of oxytetracycline and streptomycin was given in Case 1; a combination of procaine penicillin and streptomycin was administered in Case 2.

Energetic rehydration was applied in both instances.

Although the reactions to the previous antibiotic treatment resulted in a sudden paroxysmal intensification of symptoms, the recovery in both patients was satisfactory.

Deaths

Akers, Theron A., Chicago; Chicago College of Dental Surgery, Loyola University, 1925; died December 22, 1956; aged 54.

Anderson, Arthur J., Chicago; Columbian Dental College, Chicago, 1898; died August 20, 1956; aged 78.

Arnow, Martin, Brookline, Mass.; Tufts University School of Dental Medicine, 1943; died December 12, 1956; aged 35.

Asprey, William J., Prospect Park, Pa.; University of Pennsylvania School of Dentistry, 1917; died November 15, 1956; aged 60.

Babington, Harold W., Columbus, Ohio; Ohio State University College of Dentistry, 1918; died November 2, 1956; aged 60.

Bastian, Minot V., Clinton, Mass.; University of Pennsylvania School of Dentistry, 1898; died December 24, 1956; aged 79.

Baughman, Jesse E., Marion, Va.; Vanderbilt University School of Dentistry, 1925; died December 1, 1956.

Behrens, Frederick A., Gillespie, Ill.; Washington University School of Dentistry, St. Louis, 1933; died December 17, 1956; aged 48.

Bell, Joseph, Winthrop, Wash.; North Pacific College of Oregon, School of Dentistry, Portland, 1918; died December 31, 1956; aged 67.

Bergmann, William C., Brooklyn; New York College of Dentistry, 1914; died November 24, 1956; aged 65.

Bigger, James F., Memphis, Tenn.; University of Tennessee College of Dentistry, 1915; died December 24, 1956; aged 69.

Boyd, Walter L., Boston; Tufts University School of Dental Medicine, 1906; died December 14, 1956.

Boye, Kenneth, Miami, Fla.; University of Buffalo School of Dentistry, 1953; died November 1956; aged 27.

Bringhurst, Theodore, Shawnee, Okla.; University of Tennessee College of Dentistry, 1900; died December 25, 1956; aged 82.

Brock, James L., Florence, Ala.; Louisville College of Dentistry of Centre College, 1902; died December 12, 1956; aged 84.

Brownlie, Ira C., Denver; Northwestern University Dental School, 1897; died December 8, 1956; aged 83.

Bulkowstein, Marcus, New York; New York College of Dental and Oral Surgery, 1905; died June 6, 1956; aged 82.

Burrows, Wilbert G., Detroit; University of Michigan College of Dental Surgery, 1919; died December 2, 1956; aged 63.

Bushong, Stuart F., La Jolla, Calif.; University of Pennsylvania School of Dentistry, 1909; died May 20, 1956; aged 71.

Butler, Martyn E., Centralia, Kan.; Kansas City-Western Dental College, 1930; died December 6, 1956; aged 50.

Caldwell, George T., Fairfield, Ill.; St. Louis University School of Dentistry, 1911; died August 10, 1956; aged 66.

Carter, Lloyd, Bringhurst, Ind.; Indiana Dental College, 1912; died December 4, 1956; aged 67.

Charles, Oscar R., Branchport, N. Y.; University of Buffalo School of Dentistry, 1903; died November 25, 1956; aged 79.

Cohen, Maximilian, Brooklyn; New York University College of Dentistry, 1912; died December 12, 1956; aged 62.

Cohen, Paul T., Stapleton, Staten Island, N. Y.; College of Dental and Oral Surgery, New York, 1922; died December 18, 1956; aged 56.

Coleman, Frederick H., Wilmington, N. C.; Atlanta Dental College, 1916; died October 14, 1956; aged 63.

Cooksey, Barney C., Sherman, Texas; Northwestern University Dental School, 1931; died December 23, 1956; aged 55.

Corder, George W., Kansas City, Mo.; Washington University School of Dentistry, St. Louis, 1899; died December 30, 1956; aged 88.

Crook, Leo V., Grenada, Miss.; Washington University School of Dentistry, St. Louis, 1927; died December 26, 1956; aged 51.

Culver, Rollin P., De Kalb, Ill.; Chicago College of Dental Surgery, Loyola University, 1902; died August 2, 1956; aged 86.

Cunningham, Peter T., New York, N. Y.; Washington University School of Dentistry, St. Louis, 1895; died June 1, 1956; aged 83.

Davis, James W., Youngstown, Ohio; Indiana University School of Dentistry, 1927; died December 26, 1956; aged 62.

Davis, Joseph H., Salt Lake City; Northwestern University Dental School, 1913; died December 10, 1956; aged 69.

Davis, Walter W., Boston; University of Pennsylvania School of Dentistry, 1900; died December 11, 1956; aged 81.

Dellibac, LeRoy, Kankakee, Ill.; Northwestern University Dental School, 1899; died December 15, 1956; aged 78.

Dowd, Edward F., Dorchester, Mass.; died December 25, 1956; aged 58.

Dreher, George C., Short Hills, N. J.; Baltimore College of Dental Surgery, University of Maryland, 1910; died December 18, 1956; aged 67.

Dunning, Philo F., Amsterdam, N. Y.; University of Buffalo School of Dentistry, 1919; died December 22, 1956; aged 60.

Eberhart, Joseph O., Atlanta, Ga.; Atlanta-Southern Dental College, 1926; died December 22, 1956; aged 53.

Engel, Ignatius L., Portland, Ore.; North Pacific College of Oregon, School of Dentistry, Portland, 1926; died December 25, 1956; aged 62.

Enholm, Philip A., Newton, Mass.; Tufts University School of Dental Medicine, 1919; died December 27, 1956; aged 59.

Eppleman, Charles C., Hollywood, Fla.; Temple University School of Dentistry, 1912; died December 23, 1956; aged 73.

Essig, George S., Swarthmore, Pa.; University of Pennsylvania School of Dentistry, 1899; died December 30, 1956; aged 81.

Falls, John B., Houston, Texas; Vanderbilt University School of Dentistry, 1916; died December 26, 1956; aged 64.

Finot, Philip, St. Louis; St. Louis Dental College, 1905; died July 16, 1956; aged 97.

Ford, Bernard J., Nanticoke, Pa.; University of Pennsylvania School of Dentistry, 1919; died December 29, 1956; aged 59.

Forman, Milton, Washington, D. C.; George Washington University Dental Department, 1917; died December 22, 1956; aged 75.

Gabrielson, Benjamin, Scarsdale, N. Y.; Columbia University School of Dental and Oral Surgery, 1919; died December 5, 1956; aged 61.

Gilardi, Thomas S., Pittsburgh; University of Pittsburgh School of Dentistry, 1927; died December 24, 1956; aged 61.

Goggins, Jean B., Cleveland; Howard University College of Dentistry, 1910; died December 6, 1956; aged 72.

Grahn, Earl G., Chicago; Northwestern University Dental School, 1922; died December 30, 1956; aged 56.

Grant, Leslie H., Fort Myers, Fla.; Temple University School of Dentistry, 1892; died October 29, 1956; aged 86.

Greenblatt, Leo A., Detroit; University of Michigan College of Dental Surgery, 1931; died December 29, 1956; aged 51.

Gutchell, Glenn C., Anaconda, Mont.; North Pacific College of Oregon, School of Dentistry, Portland, 1938; died December 15, 1956; aged 44.

Harris, Leon, New York; New York College of Dentistry, 1908; died December 14, 1956; aged 71.

Hayes, Roscoe D., Emory University, Georgia; Atlanta-Southern Dental College, 1935; died December 13, 1956; aged 44.

Hogan, Daniel L., Fenton, Mich.; University of Michigan College of Dental Surgery, 1929; died December 14, 1956; aged 56.

Holzman, William V., Reading, Pa.; University of Pennsylvania School of Dentistry, 1917; died December 24, 1956; aged 61.

Howatt, Arthur B., Chicago; Chicago College of Dental Surgery, Loyola University, 1896; died July 5, 1956; aged 87.

Hughes, James L., Carmel, Calif.; died December 8, 1956; aged 72.

Hussey, Simeon A., Gainesville, Fla.; Atlanta Dental College, 1905; died December 13, 1956; aged 75.

Jenks, Louis A., Syracuse, N. Y.; University of Pennsylvania School of Dentistry, 1901; died December 19, 1956; aged 78.

Johnson, Webster A., Duluth, Minn.; University of Minnesota College of Dentistry, 1925; died December 11, 1956; aged 57.

Jones, Frank T., Sacramento, Calif.; University of Louisville School of Dentistry, 1923; died December 25, 1956; aged 55.

Jones, Martha E., Detroit; College of Dental and Oral Surgery, New York, 1919; died December 12, 1956; aged 69.

Justice, Joseph M., Northfork, W. Va.; University of Louisville School of Dentistry, 1925; died December 4, 1956; aged 61.

Kallusky, Edwin A., Annandale, Minn.; University of Minnesota College of Dentistry, 1921; died December 5, 1956; aged 57.

Keith, Willium W., Arkoma, Okla.; died July 26, 1956; aged 69.

Knight, Lemuel W., Jacksonville, Fla.; Atlanta-Southern Dental College, 1919; died October 20, 1956; aged 64.

Krejci, Edward J., La Grange, Ill.; University of Illinois College of Dentistry, 1915; died January 8, 1957; aged 64.

Landis, Ben Ami, Brooklyn; Tufts University School of Dental Medicine, 1936; died October 17, 1956; aged 45.

Landrum, Arthur W., Kosciusko, Miss.; Loyola University School of Dentistry, New Orleans, 1937; died September 6, 1956; aged 44.

Lassaline, Wilfred J., Detroit; University of Michigan College of Dental Surgery, 1919; died December 20, 1956; aged 60.

Lavien, Leo H., West Palm Beach, Fla.; Tufts University School of Dental Medicine, 1914; died December 25, 1956; aged 63.

MacDonald, Allan B., Detroit; died August 14, 1956; aged 57.

Ross, William R., Boston; died October 25, 1956; aged 74.

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THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION
222 East Superior Street, Chicago 11, Illinois
WHitehall 4-6730

LON W. MORREY, *Editor* JOHN J. HOLLISTER, *Business Manager*

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Announcements

MEETINGS OF THE AMERICAN DENTAL ASSOCIATION

Ninety-Eighth Annual Session	Nov. 4-7, 1957	Miami, Fla.
Ninety-Ninth Annual Session	Nov. 10-13, 1958	Dallas, Texas
One-Hundredth Annual Session	Sept. 21-24, 1959	New York
One-Hundred and First Annual Session	Oct. 17-20, 1960	Los Angeles

MEETINGS OF CONSTITUENT SOCIETIES

State	Date	Place	Secretary	Address
Alabama	Apr. 16-18	Birmingham	F. A. Finney, Jr.	Box 787, Gadsden
Alaska	June 5-8	Ketchikan	C. L. Polley	Box 1896, Juneau
Arizona	May 1-4	Chandler	W. G. Burke	17 E. Weldon Ave., Phoenix
Arkansas	Apr. 7-10	Little Rock	D. M. Hamm	Box 89, Clarksville
California	Apr. 15-17	San Francisco	W. J. Healy	450 Sutter St., San Francisco
S. California	Apr. 7-10	Los Angeles	S. M. Silverman	903 Crenshaw Blvd., Los Angeles 19
Colorado	Oct. 6-9	Colorado Springs	G. H. Jackson	Republic Bldg., Denver
Connecticut	May 15-17	Hartford	E. S. Arnold	37 Linnard Rd., W. Hartford
Delaware			A. G. Schiek	3716 Philadelphia Pike, Claymont
District of Columbia			J. F. Keaveny	1029 Vermont Ave., N.W., Washington
Florida	Apr. 15-17	St. Petersburg	W. C. Mayo	Brent Annex, Pensacola
Georgia	Sept. 29-Oct. 2	Atlanta	J. W. Yarbrough	Southern United Bldg., Macon
Hawaii	June	Honolulu	J. H. Dawe	810 N. Vineyard St., Honolulu
Idaho	May 16-18	Pocatello	M. R. Johnson	1606 E. Center St., Pocatello
Illinois	May 12-15	Peoria	P. W. Clopper	Jefferson Bldg., Peoria
Indiana	May 20-22	Indianapolis	W. R. Shoemaker	Citizens Bank Bldg., Anderson
Iowa	May 5-8	Des Moines	H. I. Wilson	Insurance Exchange Bldg., Des Moines
Kansas	May 13-16	Wichita	F. A. Richmond	Brotherhood Bldg., Kansas City 1
Kentucky	Mar. 31-Apr. 3	Louisville	A. B. Coxwell, Jr.	1976 Douglass Blvd. Louisville
Louisiana	Apr. 24-27	Lake Charles	J. S. Bernhard	2515 Line Ave., Shreveport
Maine	June 20-22	Kennebunkport	S. M. Gower	Box 27, Skowhegan
Maryland	May 5-8	Baltimore	C. L. Inman, Jr.	Medical Arts Bldg., Baltimore
Massachusetts	May 5-8	Boston	H. E. Tingley	12 Bay State Rd., Boston 15
Michigan	Apr. 8-10	Detroit	F. Wertheimer	Michigan Dept. of Health, Lansing
Minnesota	Apr. 1-3	Minneapolis	C. V. E. Cassel	2236 Marshall Ave., St. Paul 4W.
Mississippi	Apr. 28-May 1	Jackson	B. A. Cohen	500-E E. Woodrow Wilson, Jackson 27
Missouri	May 26-29	St. Louis	E. D. Suggett	Merchants Bank Bldg., Jefferson City
Montana	May 1-3	Billings	E. G. Vedova	Box 311, Roundup
Nebraska	Apr. 29-May 1	Lincoln	F. A. Pierson	Federal Securities Bldg., Lincoln
Nevada	May 5-7	Las Vegas	O. M. Seifert	755 Ryland Ave., Reno
New Hampshire	June 16-19	Whitefield	F. E. Williams	814 Elm St., Manchester
New Jersey	May 12-15	Atlantic City	J. G. Carr	407 Cooper St., Camden
New Mexico	May 19-22	Albuquerque	J. S. Eilar	7 Medical Arts Sq., N.E., Albuquerque
New York	May 20-22	New York	C. A. Wilkie	1 Hanson Pl., Brooklyn
North Carolina	May 5-8	Pinehurst	L. H. Butler	Jefferson Bldg., Greensboro
North Dakota	Apr. 28-May 1	Fargo	J. H. Pfister	419½ Dakota Ave., Wahpeton

State	Date	Place	Secretary	Address
Ohio	Oct. 6-9	Columbus	E. G. Jones	185 E. State St., Columbus
Oklahoma	Apr. 14-17	Tulsa	S. A. Russman	1219 Classen Dr., Oklahoma City
Oregon			T. D. Holder	Selling Bldg., Portland
Panama Canal Zone	Apr. 4, 5	Albrook A.F.B.	A. L. Robertson	5700 USAF Dispensary, Albrook Air Force Base
Pennsylvania	May 23-25	Harrisburg	M. D. Zimmerman	217 State St., Harrisburg
Puerto Rico	January 1958		R. Borges	Box 843, Arecibo
Rhode Island	January 1958	Providence	W. F. Decesare	216 Broadway, Providence
South Carolina	May 12-14	Myrtle Beach	J. E. Wallace	1420 Gregg St., Columbia
South Dakota	May 12-15	Watertown	R. E. Decker	Box 308, Parker
Tennessee	May 13-16	Gatlinburg	A. M. Ballentine	215 W. Flower St., Pulaski
Texas	Apr. 28-May 1	Houston	W. Ogle	3707 Gaston Ave., Dallas 10
Utah	May 23-25	Salt Lake City	R. C. Dalgleish	State Capitol Bldg., Salt Lake City
Vermont	May 26-28	Manchester	E. H. Van Santvoord	22 Washington St., Rutland
Virginia	Apr. 29-May 1	Virginia Beach	W. T. McAfee	Colonial National Bank Bldg., Roanoke
Washington	Apr. 1-3	Seattle	J. M. Deines	Medical & Dental Bldg., Seattle
West Virginia	July 21-24	White Sulphur Springs	G. N. Casto, Jr.	3820 McCorkle Ave., S.E., Charleston
Wisconsin	Apr. 29-May 1	Milwaukee	H. O. Hoppe	1331 W. Vliet St., Milwaukee
Wyoming	June	Sheridan	T. J. Drew	State Office Bldg., Cheyenne

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

State	Date	Place	Secretary	Address
Alabama	June 9-14* June 10, 11†	Birmingham	W. L. McCarty	Professional Bldg., Montgomery
Alaska	July 9-12*†	Anchorage	R. H. Williams	Box 2122, Juneau
Arizona	June 24-28* June 26†	Florence	W. G. Biddulph	1502 W. Osborn Rd., Phoenix
Arkansas	June 17-21	Little Rock	W. T. Jones	107 E. Shelton, Monticello
California	June 24 July 29	Los Angeles San Francisco	T. G. Atwood	450 Sutter St., San Francisco
Colorado	June 24-28‡		R. F. Gilmore	Republic Bldg., Denver 2
Connecticut	June 24-26* June 28, 29* June 27-29†	Boston Bridgeport Bridgeport	C. G. Brooks	302 State St., New London
Delaware	June 24*† June 25-27*†	Philadelphia Wilmington	P. K. Musselman	143 W. Main St., Newark
District of Columbia			W. T. Birthright	1835 Eye St., N.W., Washington
Florida	July 8-18*†	Jacksonville	R. P. Taylor, Jr.	P. O. Box 2913, Jacksonville 3
Georgia			W. G. Brown	Blackshear
Hawaii	Aug. 29-Sept. 2*†	Honolulu	J. Y. Ing	210 James Campbell Bldg., Honolulu
Idaho	June 24-26	Boise	A. G. DeWinter	Sun Bldg., Boise
Illinois	June 25-28		W. A. McKee	Wood Bldg., Benton
Indiana	June 11-14*†	Indianapolis	C. A. Frech	Gary National Bank Bldg., Gary
Iowa	May 27-31*†	Iowa City	P. A. Hahn	Farmers & Merchants Bank Bldg., Burlington
Kansas	June 3-6	Kansas City, Mo.	G. L. Teall	Box 71, Hiawatha
Kentucky	June 10-13*†	Louisville	J. J. Kelly	102 W. Madison St., Franklin
Louisiana	June 2-7‡		R. C. Steib	Maison Blanche Bldg., New Orleans
Maine			A. S. Appleby	Box 260, Skowhegan
Maryland	June 10-12‡		H. Levin	3429 Park Heights Ave., Baltimore 15
Massachusetts	June 18-21*‡ June 20, 21†‡		A. M. Bommer	349 Broadway, Revere
Michigan	June 9-15	Ann Arbor	J. L. Champagne	3714 W. McNichols Rd., Detroit 21
Minnesota	June 17-21*†	Minneapolis	M. G. Walls	Lowry Bldg., St. Paul
Mississippi	June 18-20*†	Jackson	J. C. Boswell	Medical Arts Bldg., Jackson
Missouri	June 10-15, 17, 18* June 10, 13, 17, 18†	Kansas City	R. R. Rhoades	Central Trust Bldg., Jefferson City
Montana			R. O. Betzner	303 Power Block, Helena
Nebraska	June 10-14	Lincoln	H. E. Weber	Federal Securities Bldg., Lincoln
Nevada	June 24	Reno	A. A. Cozzalio	130 N. Virginia, Reno
New Hampshire	June 20, 21* June 20†	Boston	S. G. Markos	8 Renaud Ave., Dover

State	Date	Place	Secretary	Address
New Jersey	June 10, 11*	Philadelphia	C. J. Schweikhardt	150 E. State St.,
	June 14, 15*	Trenton		Trenton 8
	June 18, 19*	New York		
	June 26, 27*	Philadelphia		
	May 31, June 1†	Teaneck		
New Mexico	June 24-27	Santa Fe	J. J. Clarke, Sr.	Artesia
New York	July 1, 2, 9-12*‡		D. W. Beier	23 S. Pearl St.,
	July 1, 2, 9, 10†‡			Albany 7
	Dec. 10-13*‡			
North Carolina	June 24*†	Chapel Hill	J. H. Guion	Doctors Bldg., Charlotte 7
North Dakota	July 8-12	Fargo	T. M. Flath	Williston
Ohio			H. B. Smith	322 E. State St., Columbus 15
Oklahoma	June 17-19*	Oklahoma City	W. E. Cole	210 Plaza Court Bldg.,
	June 17, 19†			Oklahoma City
Oregon	June 10-13*†	Portland	F. L. Utter	Pioneer Trust Bldg., Salem
Pennsylvania	June 16-21*	Philadelphia	R. E. V. Miller, Sr.	Dept. of Public Instruction,
	June 16-19†	Pittsburgh		Box 911, Harrisburg
Puerto Rico			J. Mercado C.	Comercio St. #452,
				San Juan
Rhode Island			F. M. Hackett	267 Academy Ave.,
				Providence
South Carolina	June 13-15	Columbia	J. L. Gunter	1226 Pickens St., Columbia 1
South Dakota	June 23-26*†	Sioux Falls	H. T. Aker	Canton
Tennessee	June 10-15	Memphis	C. R. Aita	Bennie-Dillon Bldg.,
				Nashville
Texas	June 1-8*	Houston	R. T. Weber	Capitol National Bank
	June 1-4†			Bldg., Austin 16
Utah	June 24-30‡		A. Ridge, Jr.	10 S. Second E., Provo
Vermont	June 24-26*†	Burlington	P. M. Fitch	Newport
Virginia	June 10-15*	Richmond	J. M. Hughes	Medical Arts Bldg.,
	June 10, 11†			Richmond
Washington	June 24-27	Seattle	F. S. Rotchford	1108 S. Washington St.,
				Olympia
West Virginia	June 24-26	West Liberty	C. C. Cottrill	Box 111, Glen Rogers
Wisconsin	June 3-7*†	Milwaukee	S. F. Donovan	Tomah
Wyoming			W. A. Hocker	O & S Bldg., Casper

Most states require applications to be in 30 days prior to examination date.
*Dental examination. †Dental hygiene examination. ‡Write to secretary of dental examining board for information on locations of examinations.

MEETINGS OF OTHER ORGANIZATIONS

Name	Date	Place	Secy. or Chm.	Address
Academy of Denture Prosthetics	Apr. 28-May 4	Columbus, Ohio	I. L. Furnas Secy.	928 Silverado St., La Jolla, Calif.
American Academy of Dental Medicine	May 29-31	Boston	G. J. Witkin Secy.	45 S. Broadway, Yonkers, N. Y.
American Academy of Oral Pathology	Apr. 6-8	Washington, D.C.	J. L. Bernier Secy.	Armed Forces Institute of Pathology, Walter Reed Army Medical Center, Washington, D.C.
American Association of Industrial Dentists	Apr. 20-26	St. Louis	E. R. Aston Secy.	Pennsylvania Dept. of Health, P. O. Box 90, Harrisburg, Pa.
American Association of Orthodontists	May 13-16	New Orleans	E. E. Shephard Secy.	8230 Forsyth Blvd., St. Louis
American Board of Oral Surgery	Apr. 12-17	Chicago	L. M. FitzGerald Secy.	718 Roshek Bldg., Dubuque, Iowa
American Board of Pedodontics	July 25-27	San Francisco	R. L. Ireland Secy.	College of Dentistry, University of Nebraska, Lincoln 8, Neb.
American Dental Society of Europe	Aug. 28-31	Lausanne, Switzerland	J. P. Molony Secy.	110 Harley St., London W. 1, England
Berkshire Conference in Oral Pathology and Periodontology	June 16-20	Lenox, Mass.	I. Glickman Dir.	Tufts University, School of Dental Medicine, 136 Harrison Ave., Boston 11
British Columbia Dental Association	May 16-18	Victoria, B.C., Canada	D. Parfitt	Medical Dental Bldg., Vancouver, B.C., Canada
British Dental Association	July 1-5	Newcastle on Tyne, England	H. P. Buchanan Secy.	13 Hill St., Berkeley Square, London W. 1, England
Canadian Dental Association in cooperation with Western Canada Dental Society	June 23-26	Winnipeg, Canada	D. W. Gullett Secy.	Canadian Dental Association, 234 St. George St., Toronto 5, Ont., Canada

Name	Date	Place	Secy. or Chm.	Address
Chicago Dental Society	Feb. 2-5, 1958	Chicago	K. S. Richardson Exec. Secy.	30 N. Michigan Ave., Chicago
Cleveland Dental Society	May 6-8	Cleveland	L. H. Samartini Gen. Chm.	710 Carnegie Hall Bldg., Cleveland 15
Council on Dental Education, Dental Aptitude Tests	Apr. 26, 27		S. Peterson Secy.	222 E. Superior St., Chicago
European Organization for Research on Fluorine and Dental Caries Prophylaxis, Fourth Meeting	June 8-10	Malmo, Sweden	H. J. Schmidt	Obere Weinsteige 5, Stuttgart-Degerloch, Germany
Federation Dentaire Internationale 45th Annual Meeting	Sept. 6-14	Rome, Italy	G. H. Leatherman Secy. Gen'l	35, Devonshire Pl., London, W.1., U.K.
Fifteenth Congres Francais de Stomatologie	Sept.	Paris, France	J. Bara Gen. Secy.	30, Ave. Felix Faure, Paris 15, France
Japan Dental Association, Biennial National Meeting	Apr. 28-30	Tokyo	T. Kashima Dir.	1-Chome, Ogawa-machi, Kanda, Tokyo, Japan
National Board of Dental Examiners	Apr. 1, 2		G. J. Casey Secy.	222 E. Superior St., Chicago
National Dental Association	Aug. 4-8	Hot Springs, Ark.	J. A. Jackson Secy.	P. O. Box 197, Charlottesville, Va.
Northwest Academy of Dental Medicine	May 12-16	Sun Valley, Idaho	G. Underwood Secy.	Selling Bldg., Portland 5, Ore.
Pacific Coast Dental Conference	Aug. 19-22	San Diego	C. W. Gilman Secy.	219 E. 8th St., National City, Calif.
Semaine Odontologique Internationale, Sixty-Third Dental Congress of Paris	Apr. 11-17	Paris, France	M. Vincent Gen. Secy.	31, rue Tronchet, Paris, France
Societe Suisse d'Odontologie, Annual Congress	May 31-June 2	Bürgenstock, Switzerland	Secretary	Spitalgasse 37, Berne, Switzerland
Southeastern Society of Oral Surgeons	May 9-11	New Orleans	J. E. Skaggs Secy.	Francis Bldg., Louisville 2, Ky.
Southwestern Society of Periodontists	Apr. 27, 28	Houston, Texas	G. R. Spear Secy.	1014 South Texas Bldg., San Antonio, Texas
Third International Medical and Surgical Meetings—International Medical and Health Exhibition	June 1-9	Turin, Italy	B. Roccia Dir.	Dentistry Clinic, University of Turin, Corso Polonia 2, Turin, Italy
Twelfth International Dental Congress	Sept. 7-14	Rome, Italy	P. Lalli Secy. Gen.	Via Boezio 16, Rome, Italy
U.S.C. Dental Study Group of Mexico Tenth Annual Seminar	May 12-16	Tehuacan, Puebla	R. M. Ruff	Niza No. 6, Mexico 6, D.F

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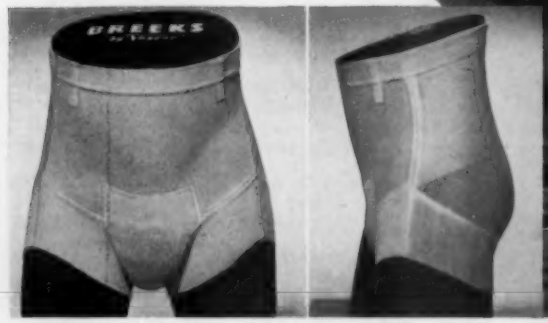

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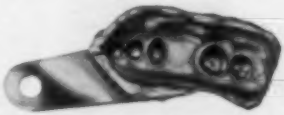

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College of Dentistry
University of California
University Medical Center
San Francisco 22, California

School of Dentistry
University of Southern California
925 West Thirty-fourth Street
Los Angeles 7, California

School of Dentistry
College of Medical Evangelists
Loma Linda, California

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3900 Reservoir Road, N.W.
Washington 7, D. C.

College of Dentistry
Howard University
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Washington 1, D. C.

GEORGIA
School of Dentistry
Atlanta-Southern Dental College
Emory University
106 Forrest Avenue, N.E.
Atlanta 3, Georgia

ILLINOIS
Chicago College of Dental Surgery
Loyola University
1757 West Harrison Street
Chicago 12, Illinois

The Dental School
Northwestern University
311 East Chicago Avenue
Chicago 11, Illinois

College of Dentistry
University of Illinois
808 South Wood Street
Chicago 12, Illinois

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1121 West Michigan Street
Indianapolis 2, Indiana

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Dental Building
Iowa City, Iowa

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Louisville 2, Kentucky

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New Orleans 18, Louisiana

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University of Maryland
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School of Dental Medicine
Tufts University
136 Harrison Avenue
Boston 11, Massachusetts

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630 East Jefferson Avenue
Detroit 26, Michigan

School of Dentistry
University of Michigan
Ann Arbor, Michigan

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Washington Ave. and Union St., S.E.
Minneapolis 14, Minnesota

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Kansas City 6, Missouri

School of Dentistry
St. Louis University
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St. Louis 4, Missouri

School of Dentistry
Washington University
4559 Scott Avenue
St. Louis 10, Missouri

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College of Dentistry
University of Nebraska
Lincoln 8, Nebraska

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Teaneck, New Jersey

College of Dentistry
Seton Hall University
Jersey City Medical Center
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Buffalo 14, New York

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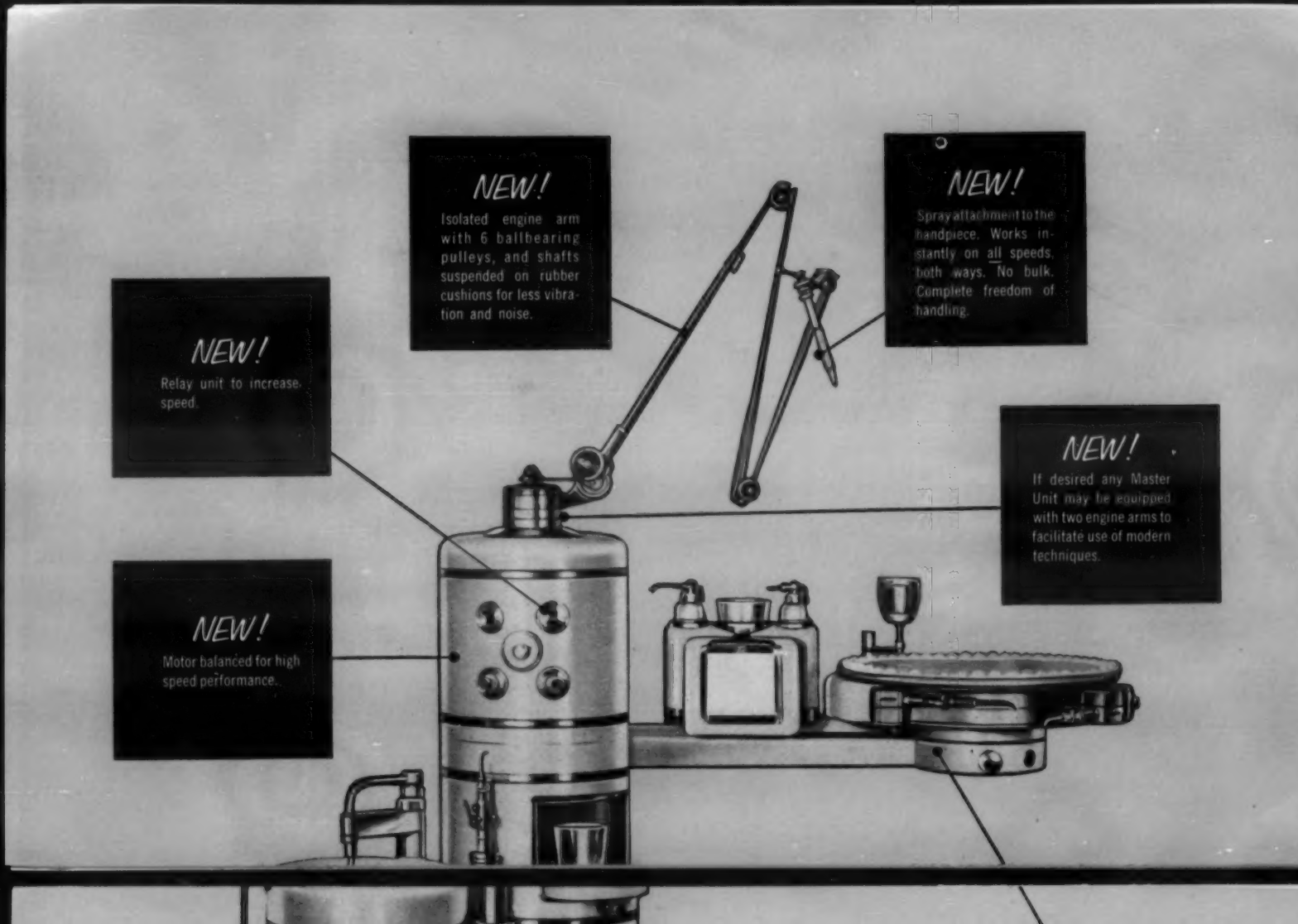
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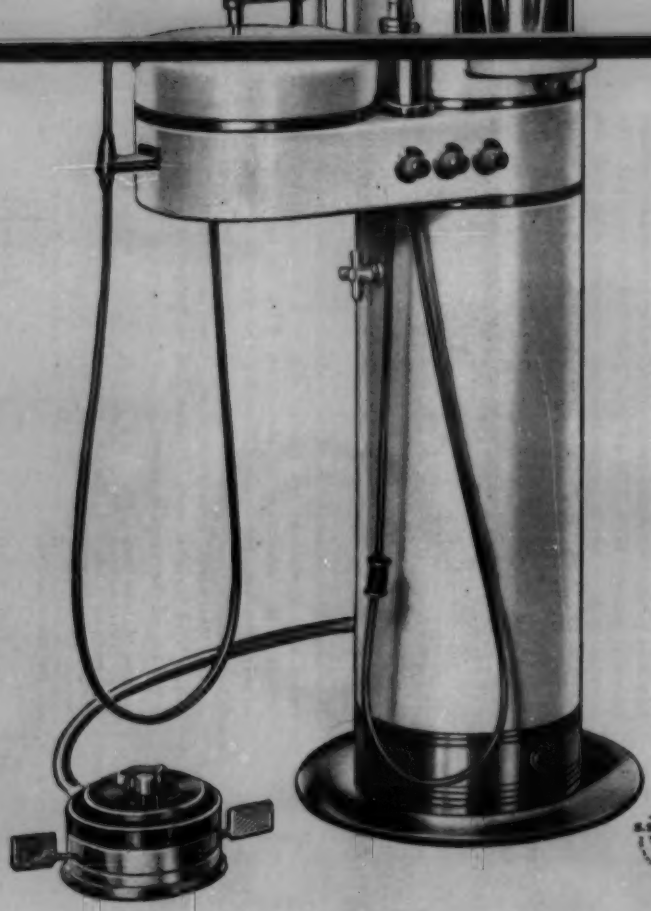

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1. Bowes, A. deP.: Dietotherapy—Nutrition of Children During Their School Years, Am. J. Clin. Nutrition *3*:234 (May-June) 1955.

2. Sebrell, W. H., Jr.: Trends and Needs in Nutrition, J.A.M.A. *152*:42 (May 2) 1953.

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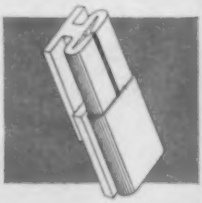

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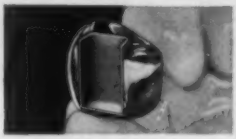

(p. 21) Showing abutment casting with Ney Chayes Attachment Tray in place. A unique timesaver, this precious metal tray simplifies two of the most difficult operations in the construction of an attachment case: the preparation of the recess and the soldering of the female.

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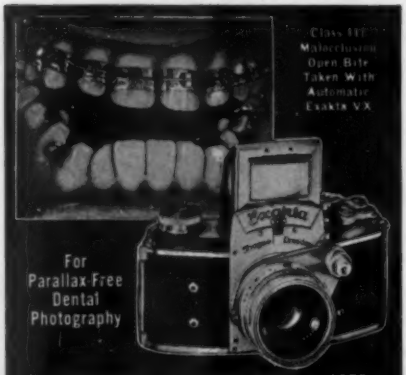

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John: *I've heard this song before. What have you done now?*

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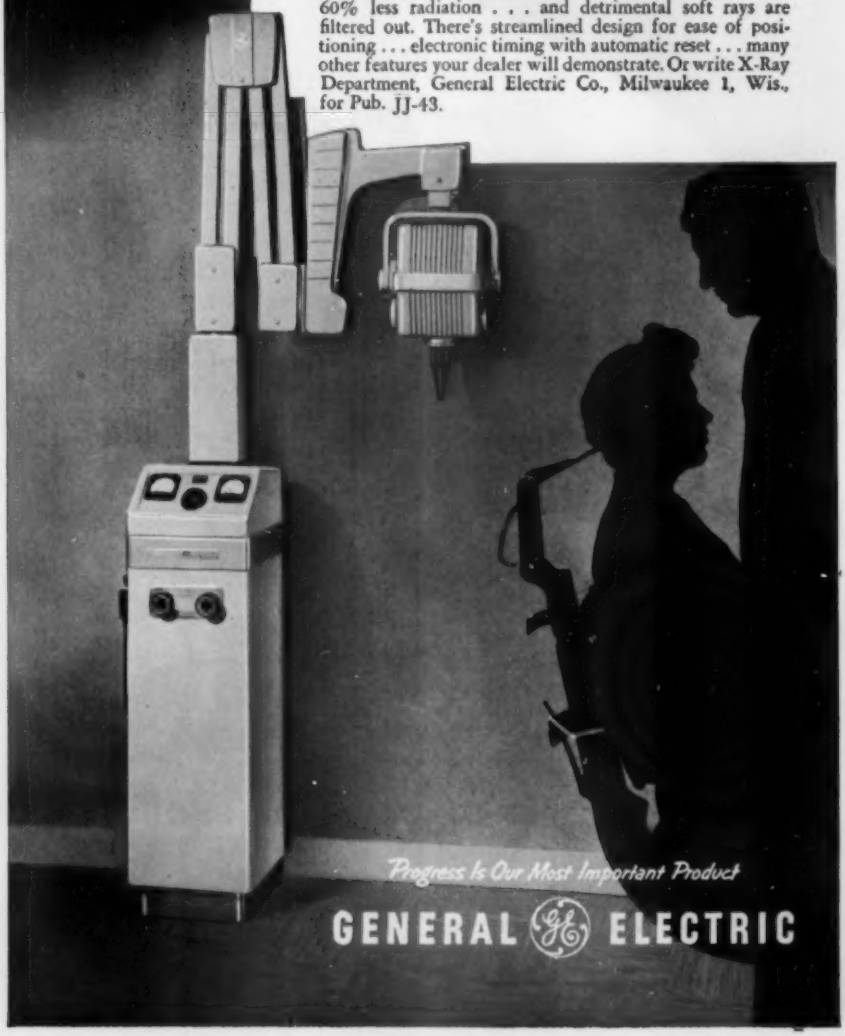

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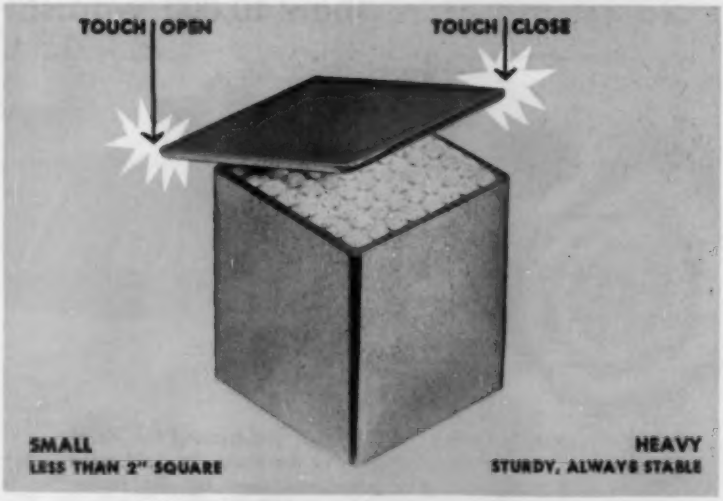

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PELLET DISPENSER

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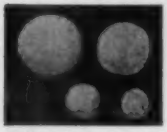
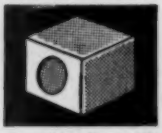
You, too, will want TILTOP on your bracket table because it is »»»



Pellets #1, 2, 3 and 4



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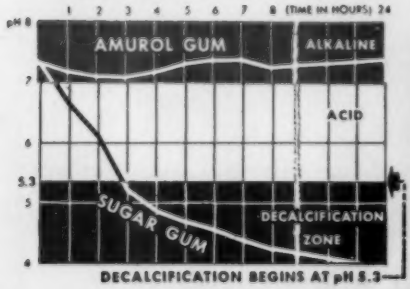

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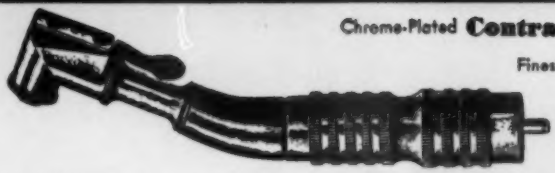

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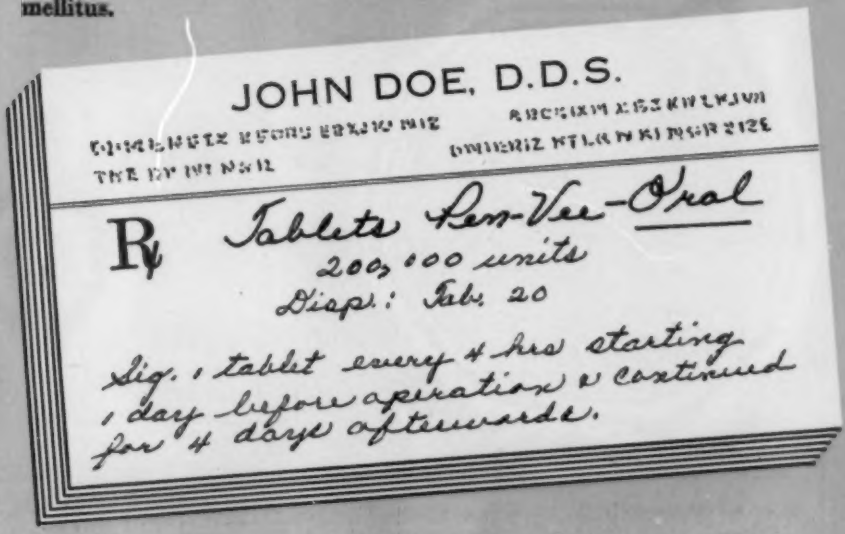
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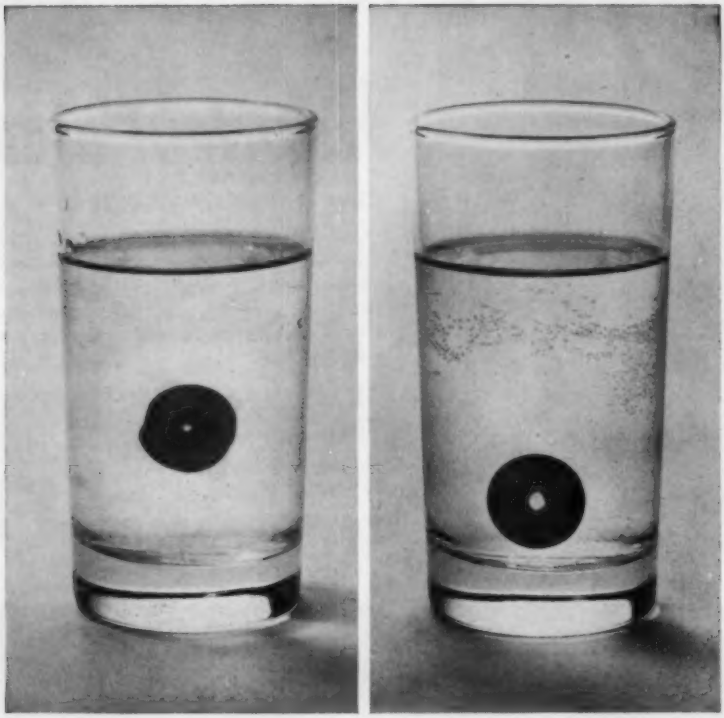

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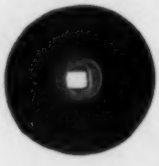

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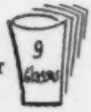
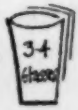
Vitamin C recommendations for peak intakes of adolescence or pregnancy (100 mg. per day)* are supplied by (7-9 fl. oz.) of citrus juice. But it takes of apple juice, or  of grape juice, or  of pineapple juice, or of prune juice to supply this amount of vitamin C.†

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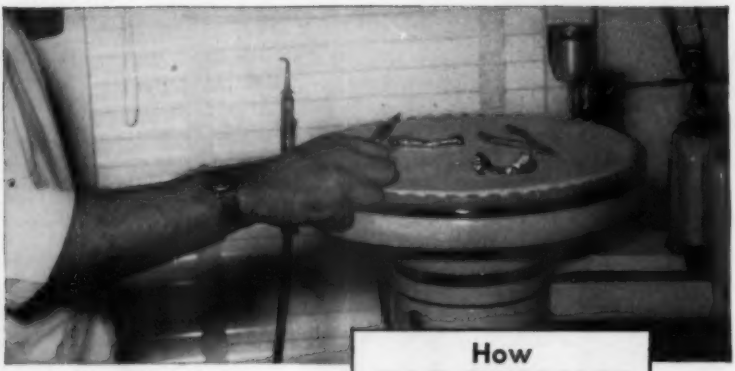

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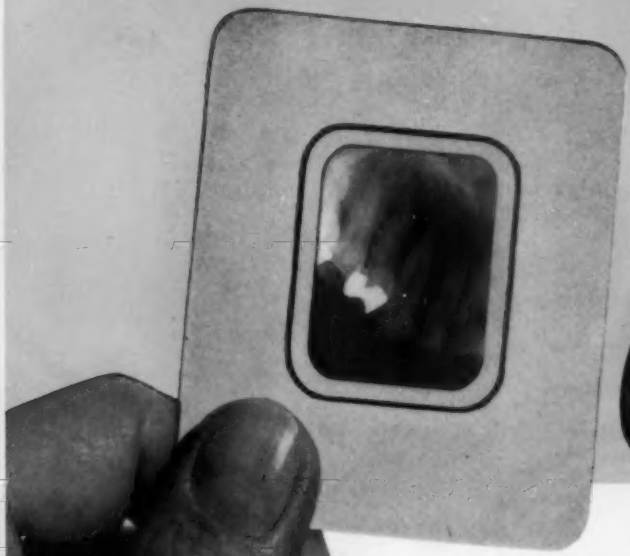

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New Jersey, New York licensed dentist. Oral surgery internship and military service completed. Desires general practice association with dentist or group with opportunity for eventual partnership or purchase perferably in New Jersey. Address A.D.A. Box No. 590.

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Desire full time position with dental school, government, industry; Pennsylvania licensed. 1951 graduate. Three years' Navy service. Navy rotating internship. Highest references concerning ethics, integrity, quality of work. Dr. Dallas C. Hess, 1622 Spring Ave., Jenkintown, Pa.

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Ohio licensed dentist, 29 years of age, married, veteran, Ohio State University graduate, United States Public Health Service, rotating internship. Desires association with dentist or group in progressive general practice. Available July. Hildegarde Kakehashi, 98 Sumner St., Newton Centre, Mass.

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Oral surgeon completing training July 1957. Desires association with established oral surgeon or group practice. Internship, residency, and two years' postgraduate training. New York State and National Boards, will take other boards. Military requirements completed. Married, age 32, graduated in 1950. Dr. Martin Steiner, D.D.S., 580 W. 215 St., New York.

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Connecticut and New York licensed, 1955 graduate, age 28, married with family. Wishes to associate with established dentist engaged in pedodontic or general practice in Connecticut or New York State. Completing military obligation this July. Max Macrowitz, D.D.S., 4021 McArthur Dr., Fort Smith, Ark.

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Desire location suburb of, or west of Portland. Association with older man. Will purchase, or will work for two or three months this summer. Age 49. Address A.D.A. Box No. 575.

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On the Protein Quality of the Oatmeal Serving

It has long been known by nutritionists (and probably some laymen) that the standard serving of oatmeal and milk supplies 9 grams of readily available protein. Perhaps less well known is the biologically excellent *quality* of the protein content of the oatmeal breakfast dish.

Quantitatively, rolled oats has a higher average protein content than any other whole grain cereal.[1] Nutritionally, the quality of the protein is reflected in the contained amounts of essential amino acids. Chemical analyses of cereal proteins reveal oats to be relatively rich in essential amino acids. Confirmatory biological evidence for this is apparent from comparative studies of protein quality of various breakfast cereals.[2]

Feeding tests with small animals and human subjects indicate the amino acids of rolled oats to be readily available for absorption and utilization because of the high digestibility of oat protein.[3, 4, 5] The high nutritional value of the rolled oats-and-milk combination was proved many years ago in human feeding experiments in which the protein value was studied in terms of maintaining nitrogen equilibrium.[6] The excellent quality of the combination of proteins in the standard serving of oatmeal and milk is also evident in results of growth tests with weanling rats.[7]

Readily available high-quality protein is important to children for growth promotion and development, and to adults for normal maintenance and repair of tissue. The oatmeal-and-milk serving provides such protein, as well as valuable amounts of vitamins and minerals.

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1. Watt, B.K., and Merrill, A.L.: Composition of Foods—Raw, Processed, Prepared, Washington, D.C., United States Department of Agriculture, Agricultural Handbook No. 8, 1950.
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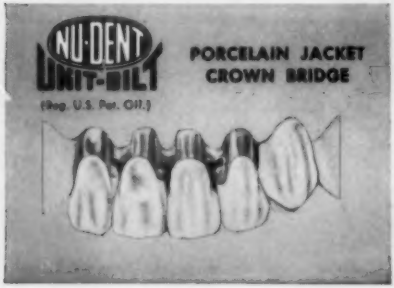

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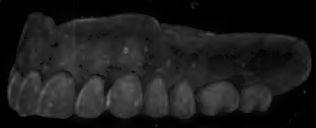

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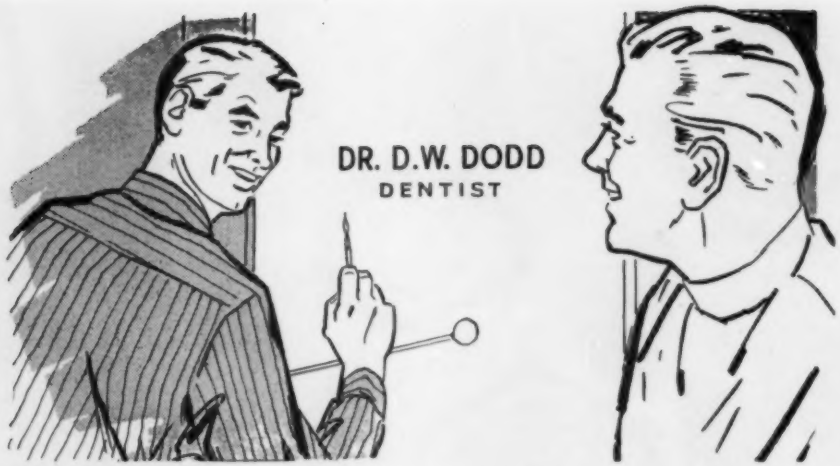

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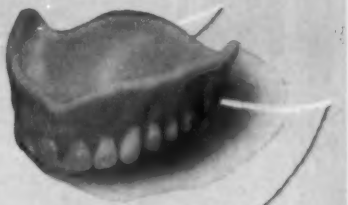

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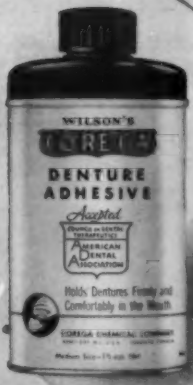

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DENTAL X-RAY NEWS

No. 8

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Here's a simple test for fogging: Open an unexposed dental packet and pull the film halfway out of its protective paper. Place the packet in a spot where your hanger is loaded and expose the film to the illumination of your safelight for length of time it takes to mount a full-mouth series. Develop the test film and inspect. If fog appears on unprotected half of film, intensity of your safelight should be reduced.

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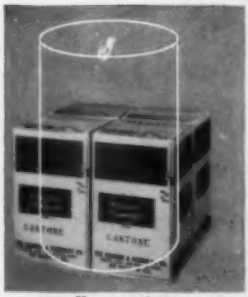

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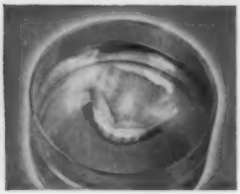

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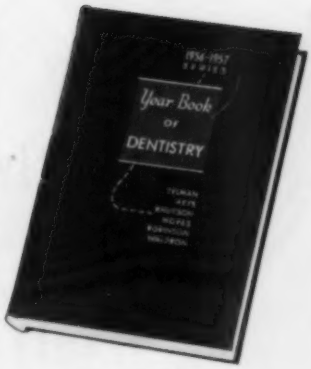

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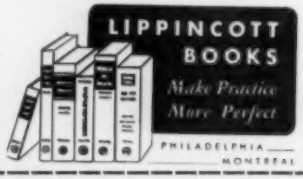

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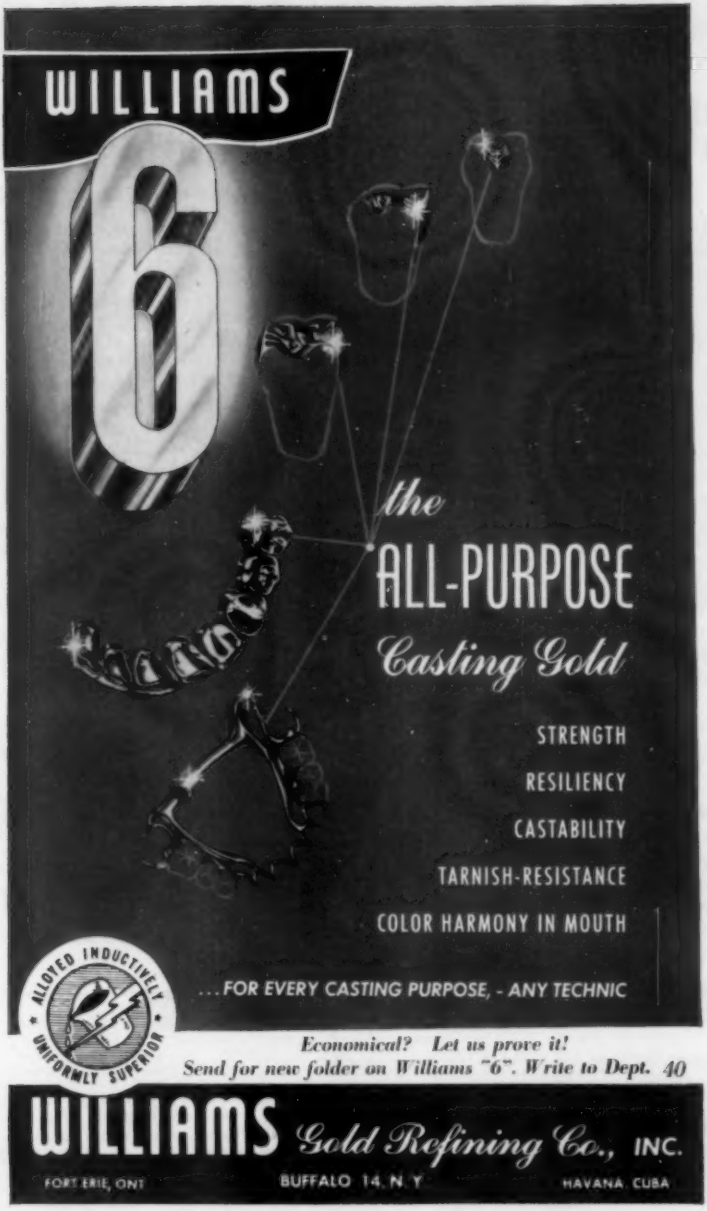

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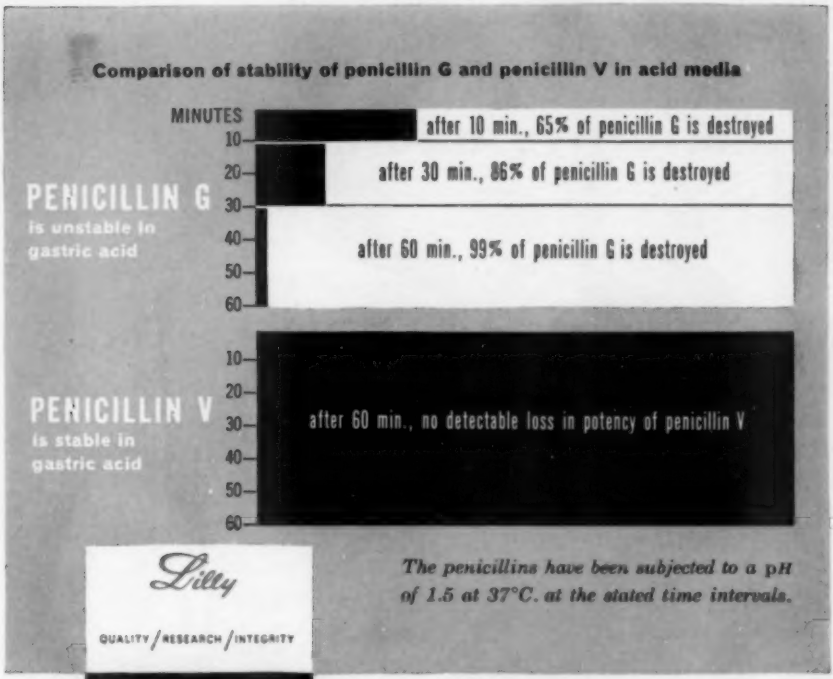
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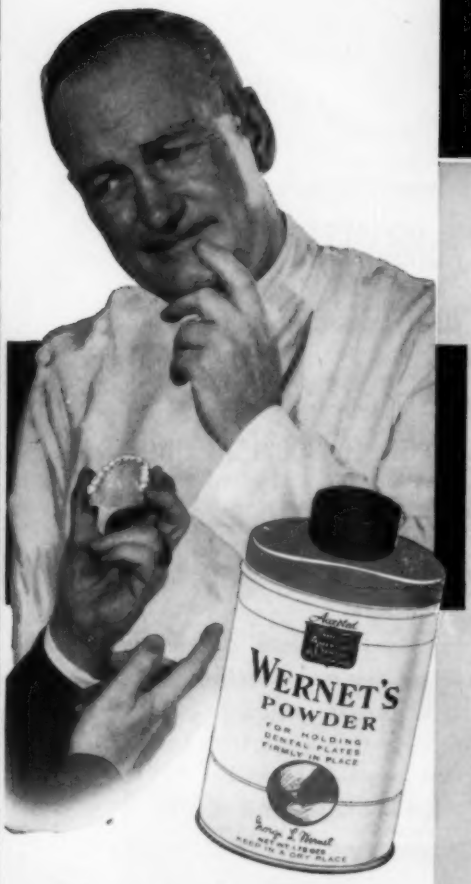

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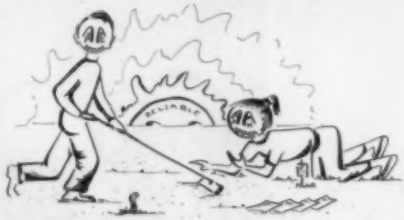

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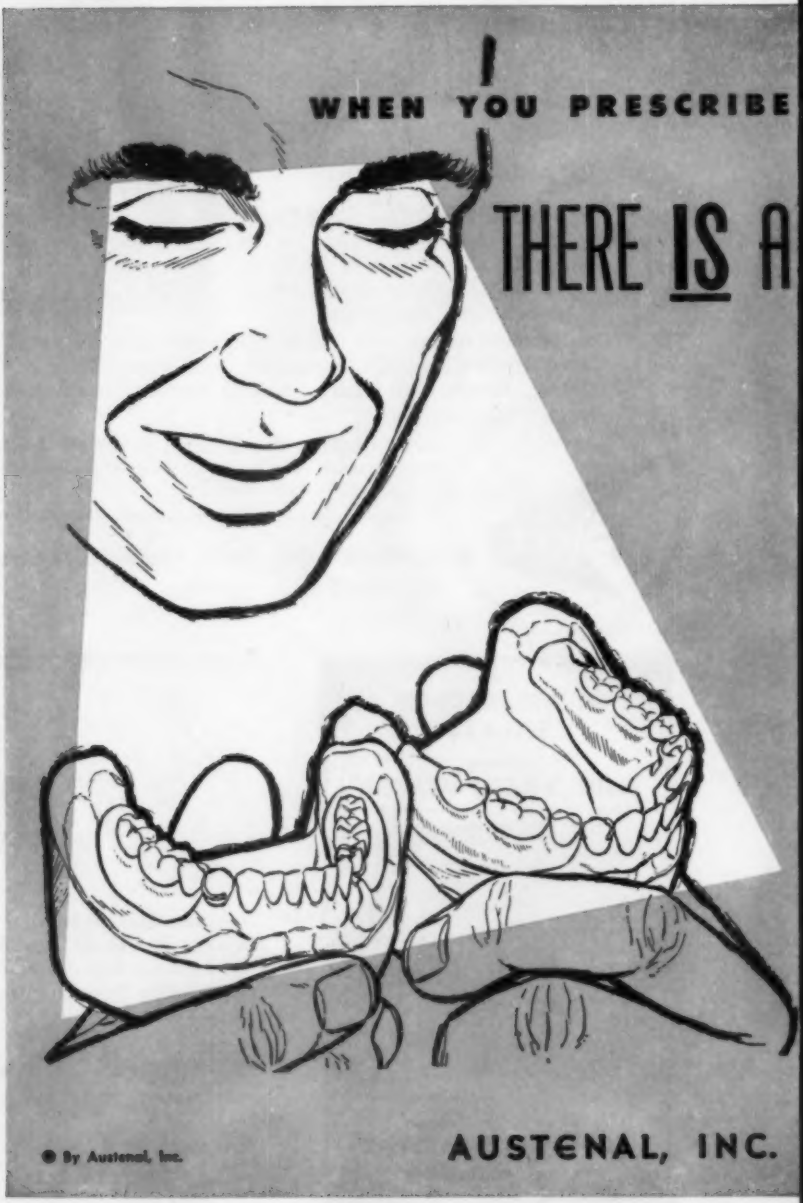
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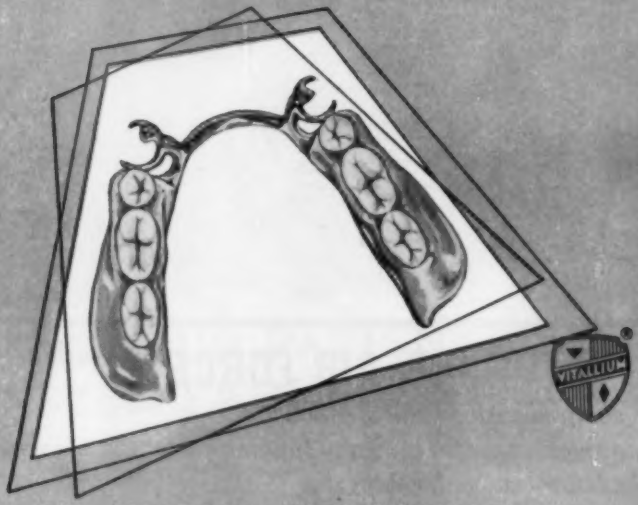

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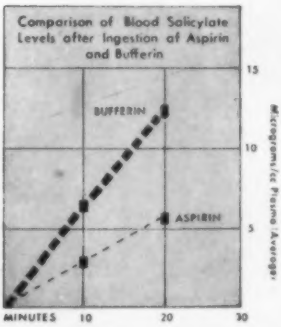

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